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INORGANIC CHEMISTRY.

The Radioactivity of Thorium Compounds. I. An Investigation of the Radioactive Emanation. BY E. RUTHERFORD AND FREDERICK SODDY. *J. Chem. Soc.* (London), 81, 321–350.—A method of measuring, with considerable accuracy, the intensity of the effect of radioactive substances was devised. It is based upon the well-known property of such radiations of "ionizing" gases and thus enabling them to transport electrical charges. The magnitude of this effect was measured by means of a quadrant electrometer. This method is said to give much more accurate results than the ordinary photographic method. Thoria produces two kinds of radiations. One is of the ordinary sort and travels in straight lines. The other seems to be due to a radioactive gas. The latter emanation can be carried by currents of various gases through bent tubes, through plugs of cotton, through wash-bottles containing sulphuric acid or alkali without being retained or absorbed or having its activity diminished. To measure the radioactivity of this emanation, dry air or other gas was passed over a definite weight of thoria, then through a cotton plug and finally between electrodes connected on the one side with a battery giving 50 to 100 volts and on the other with the quadrant electrometer. The activity of the "ionized" air or other gas diminishes rather rapidly. The rate of "decay" was determined by causing the gas to pass slowly between three successive pairs of electrodes and noting the decrease of the effect. The radiations of different substances show different rates of decay, but the rate was uniform for all kinds of thorium compounds. It was found that samples of thoria from widely different sources had about the same activity. The emanating power of 10-gram portions of a certain lot of thoria was used as

the unit of comparison. The amount of emanation, that is, the effect as shown by the electrometer, was found to be directly proportional to the weight of the substance. Thoria loses its emanating power partially by heating. A sample having but 7 per cent. of its original activity was obtained by heating strongly. Loss of activity is not due to loss of moisture. The "straight line" radiation of thoria was not diminished by ignition. De-emanated thoria may be rendered active by converting it into chloride and then into hydroxide. The hydroxide was more active than the original thoria before de-emanation. After four days it was $1^1/_2$ times, and after twelve days it was $2^1/_2$ times as active as the original sample. The activity of thorium hydroxide reaches a maximum only after a week or two. Samples of thorium compounds have been separated into small, very active portions and larger slightly active portions. These separations were made by fractional precipitation of solutions of the salts or by washing crude thoria repeatedly with water. The evaporation of the wash-water from 290 grams of thoria yielded 6.4 mg. of residue which was 1800 times as active as an equal weight of the original thoria. In this extremely active residue no other substance than thoria could be detected by chemical analysis.

H. N. McCoy.

On Some Hydroxylamine Compounds. By Maxwell Adams. *Am. Chem. J.*, **28**, 198–219.—The methods of preparation and estimation of hydroxylamine are discussed, and a number of new compounds described. The method of preparation of Divers and Haga was improved in several ways. Sulphur dioxide was obtained from the commercial liquid substance. In the process of saturating the carbonate-nitrite solution with sulphur dioxide, decomposition was entirely prevented by using a small excess of sodium carbonate over two molecules of the latter substance to one of sodium nitrite. A method of readily separating the hydroxylamine sulphates from sodium sulphate is given, together with one for working up the mother-liquors by means of the phosphate. Tables of solubilities of the sulphate and the phosphate are given. The bromide, $NH_2OH.HBr$, made from barium bromide and hydroxylamine sulphate, forms large acicular crystals, very soluble in water. Stable, if pure. $(NH_2OH)_2.HBr$, plate-like crystals, very soluble in water. $NH_2OH.HI$, from hydroxylamine and hydriodic acid, in ligroin solution, crystalline precipitate, unstable either dry or in water solution. $HgSO_4.(NH_2OH)_2.H_2O$, crystals, rather unstable. $HgCl_2.(NH_2OH)_2$, long acicular crystals from absolute alcohol. Decomposed by water, giving mercurous chloride. $HgCl_2.(NH_2OH)_4.2HCl$ crystals, from methyl alcohol. $HgCl_2.(NH_2OH)_4.HCl$ crystals, soluble in water, with subsequent decomposition. $HgCl_2.$

$NH_2OH.HCl$, crystals, extremely soluble in water and alcohol. $2HgCl_2.5(NH_2OH).HCl$, prepared in many ways. Flat hexagonal crystals, soluble in water, giving slowly mercurous chloride. $(NH_2OH)_2.HBr$, crystals. $HgBr_2.(NH_2OH)_4.2HBr$, quadratic plates. The water solution decomposes. No compound of hydroxylamine with mercuric iodide could be obtained, owing to the rapid reduction of the latter to mercurous iodide. $CdBr_2.(NH_2OH)_2$, fine crystalline precipitate from alcohol. Hot water gives a basic salt. $CdI_2.(NH_2OH)_2$, large, colorless, acicular crystals.
H. N. McCoy.

Address of the President of the British Association for the Advancement of Science. By James Dewar. Science, **16**, 533–551, 567–579, 621–631. (Delivered at Belfast, Sept. 10, 1902).—The address deals first with some of the important factors in the progress of scientific development in the last four or five decades in Great Britain and the parts played by some British scientists. The main portion of the address is devoted to a discussion of modern low temperature research, and the bearing of this work on the investigation of the upper regions of the atmosphere, auroras, comets and some related topics.
H. N. McCoy.

The Precipitation of Ammonium Vanadate by Ammonium Chloride. By F. A. Gooch and R. D. Gilbert. *Am. J. Sci.*, **14**, 205–210.—The accuracy of Gibbs' method of determining vanadium by precipitation of ammonium vanadate by ammonium chloride having been questioned by several observers, the authors have repeated Gibbs' work. When Gibbs' exact conditions are fulfilled the precipitation is practically complete and the method yields good results.
H. N. McCoy.

The Decomposition of Mercurous Chloride by Dissolved Chlorides; A Contribution to the Study of Concentrated Solutions. By T. W. Richards and E. H. Archibald. *Proc. Am. Acad. Arts and Sci.*, **37**, 347–361.—Mercurous chloride is acted upon by solutions of hydrochloric acid, sodium chloride, calcium chloride and barium chloride. Some calomel goes into solution and is apparently changed thereby into the mercuric form, while free mercury is deposited. The amount of mercury contained in the solution increases with the concentration of the soluble chloride. With equivalent solutions, up to about five times normal, hydrochloric acid and sodium chloride have about equal tendencies to effect the reaction, barium chloride has less tendency, calcium chloride still less, and cadmium chloride no appreciable tendency. The extent of the reaction, in solutions not too concentrated, is approximately proportional to the square of the concentration of the chlorine ion. This relation, taken in

connection with a number of other considerations, points to the existence of a highly ionized complex $HgCl_4''$ in the solution and thus confirms the work of LeBlanc and Noyes. The suggestion is made that this reaction may be of use as a means of determining the concentration of the chlorine ion. Corresponding reactions are much less marked with sulphates but much more so with bromides and iodides. Caution is recommended in the determination of mercury as mercurous chloride and also in the medicinal use of other chlorides in connection with calomel.

H. N. McCoy.

An Improved Drying Oven. By Edmund S. Smith. *Sci. Am.*, **87**, 186.—The oven is 9½ x 7½ x 6½ inches. It is made of No. 28 galvanized iron and lined with ¼-inch asbestos board. Heat is supplied by two 20 candle-power 110 volt lamps fixed in the lower part of the bath. One lamp alone gives a temperature of 70° C; both give 110° C. Detailed drawings accompany the article. H. N. McCoy.

The Recorded History of the Members of the Argon Group. By Henry P. Talbot. *Technology Quart.*, **15**, 195–228.—The article is an address delivered last February before the Northeastern Section of the American Chemical Society. It is a comprehensive review of the most important work done on the argon group. References to the literature are given.

H. N. McCoy.

An Acetylene Generator. By H. A. Rands. *Phys. Rev.*, **15**, 178.—A simple form of generator, constructed from two flasks and two aspirator bottles, and designed for the production for laboratory use, of small quantities of the pure gas is described. A drawing of the apparatus is given. H. N. McCoy.

Review of Some of the Recent Literature of the Periodic Law. By R. H. Bradbury. *J. Frank. Inst.*, **154**, 283–290.—The article discusses chiefly the position of hydrogen and the members of the argon group in the periodic system.

H. N. McCoy.

On Some Double and Triple Thiocyanates. By H. L. Wells. *Am. Chem. J.*, **28**, 245–284.—The more important results of this investigation are summarized as follows: (1) the description of numerous double thiocyanates (22 of them being new), among which the salts $6KSCN.Pb(SCN)_2$ and $CsSCN.4TlSCN$ present novel types, while the alkali metal salts with strontium and calcium show that alkaline earth metals enter into complex negative radicals more readily than has been supposed; (2) the conclusion, from a study of several series of salts, that the thiocyanates gen-

erally form double salts in smaller variety than the halides; and (3) the discovery of the existence of triple thiocyanates of various types, and particularly the preparation of four distinct triple salts from the thiocyanates of caesium, silver and zinc; in all, fourteen triple salts were prepared. EXPERIMENTAL.—$Cs_3Fe(SCN)_6.2H_2O$ (by W. K. Wallbridge): dark opaque tabular crystals with beautiful bronze luster, perfectly stable in the air, exceedingly soluble. Cs–Pb and K–Pb *thiocyanates* (W. K. Wallbridge and H. L. Wells). $Cs_3Pb(SCN)_5$: colorless transparent crystals, apparently monoclinic; it requires the presence of an excess of caesium thiocyanate for its formation and cannot, therefore, be recrystallized from water unless a part of the lead salt be removed by filtration. $KPb(SCN)_3$: brilliant white crystals, stable in the air, but decomposed by water. $K_6Pb(SCN)_8.2H_2O$: white opaque prisms, stable in the air. This 6 : 1 salt represents an entirely new type of double salts. Cs–*mercuric thiocyanates* (H. S. Bristol). $Cs_2Hg(SCN)_4.H_2O$: large white prisms, somewhat flattened, rather freely soluble in water, especially on warming, and may be recrystallized unchanged, m. p. 168°–170°. $CsHg(SCN)_3$: large colorless crystals, often of pyramidal habit and with numerous faces, difficultly soluble even in hot water. $Cs_4Mn(SCN)_6$ (C. S. Leavenworth): pale yellow-green crystals, massive or in slender prisms. $CsCu(SCN)_2$ (R. T. Roberts): brilliant colorless prisms, stable in the air, decomposed by water with separation of cuprous thiocyanate. Cs–Ag *thiocyanates* (H. L. Wells). $Cs_3Ag(SCN)_4$: large, transparent, colorless crystals of octahedral aspect, but evidently not isometric, and stable in the air. $Cs_2Ag(SCN)_3$: brilliant transparent colorless prisms, stable in the air. $CsAg(SCN)_2$: prismatic crystals, more flattened and with higher adamantine luster than the last. CsSCN: crystals resemble those of the potassium salt in appearance, and contain no water; they are exceedingly soluble in water and are stable in the air (unless it is very damp); it was prepared from caesium carbonate and ammonium or barium thiocyanates. K–Ag *thiocyanates* (H. F. Merriam). 3KSCN.AgSCN: beautiful large transparent stout prisms which, after drying, gradually become opaque upon standing. 2KSCN.AgSCN: large transparent crystals, stable in the air. KSCN.AgSCN: thin diamond-shaped plates. Cs–Ca, Cs–Sr and Cs–Mg *thiocyanates* (H. F. Merriam). $2CsSCN.Ca(SCN)_2.3H_2O$: colorless transparent prisms, stable in the air. $Ca(SCN)_2.4H_2O$: crystallized calcium thiocyanate carries four molecules of water, instead of three as reported by Meitzendorff (*Pogg. Ann.*, **56**, 63 (1842)); it crystallizes in long prisms, very hygroscopic, and becomes opaque on standing over concentrated sulphuric acid from change to $Ca(SCN)_2.2H_2O$. $2CsSCN.Sr(SCN)_2.4H_2O$: colorless transparent prismatic crystals with rectangular faces, and more soluble than the calcium

salt. $2CsSCN.Mg(SCN)_2.2H_2O$: clear colorless hygroscopic crystals. This salt differs in type from all the known halides of magnesium. Cs–Zn and Ag–Zn *thiocyanates* (H. L. Wells). $Cs_2Zn(SCN)_4.2H_2O$: small colorless crystals, moderately soluble in water, stable in the air. $ZnAg_2(SCN)_4$: small, brilliant, colorless prismatic crystals, stable in the air, but decomposing when boiled with water. Ba–Ag, Sr–Ag and Cs–Ag *thiocyanates* (H. L. Wells and H. F. Merriam). $Ba(SCN)_2.2AgSCN.2H_2O$: colorless prisms. $Sr(SCN)_2.2AgSCN.2H_2O$: colorless prisms. $Ca(SCN)_2.2AgSCN.2H_2O$: plates. The three latter salts are all stable in the air. $CsTl(SCN)_5$ (H. L. Wells): small fern-like growths of crystals, faint yellow when dry, and stable in the air. This 4 : 1 type is unknown among the double halides with univalent metals. $Cs_3BaAg_2(SCN)_7$ (O. G. Hupfel and H. L. Wells): large transparent tetragonal crystals resembling apophyllite, stable in the air, but readily decomposed by water; 100 parts water at 19° dissolves about 92 parts of the triple salt. $Cs_3BaCu_2(SCN)_7$ (H. L. Wells): colorless, transparent crystals similar to the last, stable in the air, decomposed by water and cannot be recrystallized from it. $Cs_3SrAg_2(SCN)_7$ and $Cs_3SrCu_2(SCN)_7$ (H. F. Merriam) closely resemble the corresponding barium salts in every respect. The last four compounds are isomorphous. $Cs_2CaAg_2(SCN)_6.2H_2O$ and $Cs_2MgAg_2(SCN)_6.2H_2O$ (H. F. Merriam) may be recrystallized from water; both form colorless transparent crystals, the magnesium salt being the less soluble of the two, and the calcium salt having about the same solubility as the preceding barium and strontium triple compounds. $Cs_2MnAg_2(SCN)_6.2H_2O$ (C. S. Leavenworth and H. L. Wells); slender needles of faint greenish tint, stable in the air, sparingly soluble. $Cs_2NiAg_2(SCN)_6.2H_2O$ and $Cs_2NiCu_2(SCN)_6.2H_2O$ (R. T. Roberts and H. L. Wells): small crystals, stable in the air, less soluble in water than the corresponding calcium, magnesium and manganese salts containing caesium and silver, and decomposed by much water. The silver salt is sapphire blue, the copper salt a greenish blue. Cs–Ag–Zn *thiocyanates* (H. L. Wells). $CsZnAg(SCN)_4.H_2O$: slender colorless flattened crystals, brilliant when removed from the mother-liquor, but quickly losing water in the air, becoming opaque and brittle. $Cs_2ZnAg(SCN)_5$: slender white needles of rectangular section, stable in the air. $CsZn_2Ag_3(SCN)_8$: small thin colorless scales, usually of rhombic or rhomboidal outline, stable in the air, slowly decomposed by cold water, more rapidly by hot. Compound crystals of different habit were also observed. $CsZn_2Ag_4(SCN)_9$: brilliant flattened colorless crystals, which vary greatly in habit, stable in the air, and slowly decomposed by water. The presence of ammonium thiocyanate appears to be necessary for the formation of this com-

pound. All the above CsZnAg salts are too insoluble to be recrystallized from water without decomposition. $K_4BaAg_2(SCN)_8.H_2O$ (H. L. Wells): truncated rectangular pyramidal crystals, brilliant and transparent, stable in the air, very soluble in small amounts of water, but decomposed by much of it with precipitation of silver thiocyanate. Most of the compounds described above were obtained by mixing the different thiocyanates in varying proportions and under different conditions, and then evaporating to crystals. M. T. BOGERT.

MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

A Quantitative Chemico-Mineralogical Classification and Nomenclature of Igneous Rocks. BY WHITMAN CROSS, JOSEPH P. IDDINGS, LOUIS V. PIRSSON AND HENRY S. WASHINGTON. *Jour. of Geol.*, 10, 555–690.—This most elaborate paper represents the combined labor of the authors, with whom the late Professor George H. Williams was originally associated, for quite a number of years. All attempts to make any of the existing systems meet the demands of modern petrology having failed, an entirely new one has been evolved which has been tested by the calculation of thousands of analyses. "Its concepts of rocks are in a large measure new, and hence, except in a very small degree, it demands a new nomenclature. . . . All igneous rocks are classified on a basis of their *chemical composition*; all rocks having like chemical composition are grouped together. The definition of the chemical composition of a rock and of a unit of classification is expressed in terms of *certain minerals* capable of crystallizing from a magma of a given chemical composition, and the expression is quantitative." It is quite impossible to give, in the limits of an abstract, an adequate idea of the nature of the proposed system and of the arguments offered in its behalf, therefore the reader must be referred to the original, which will later be reprinted in book form by the University of Chicago Press, together with a glossary of new words and their definitions and tables to aid in calculations.

Such a revolutionary step will doubtless meet with strenuous opposition, especially from the more conservative, but it is to be hoped that the spectacle of several leading petrologists united in harmonious advocacy of this radical change may have its effect in securing for the system not only approval but its gradual adoption, and thus end a most vexatious situation, quite as troublesome as that confronting chemistry.

W. F. HILLEBRAND.

The Action of Ammonium Chloride upon Silicates. BY FRANK WIGGLESWORTH CLARKE AND GEORGE STEIGER. *U. S. Geol. Survey, Bull. No. 207.* 57 pp.—In this Bulletin the authors bring together and discuss the results of their earlier work (Abstr., this Journal, **22**, 121; **23**, 73; **24**, 118) and of much that is new. The hitherto unpublished experimental data relate to the action of ammonium chloride on pollucite, datolite, elaeolite, cancrinite, sodalite, the feldspars, serpentine, phlogopite, leuchtenbergite, and rocks. There is also a discussion of the trisilicic acids. The following is the authors' summary:

"In the foregoing pages we have considered the action of ammonium chloride, at its temperature of dissociation, upon 31 mineral species. We have shown that its influence upon various silicates differs very widely, but that in general it is a much more powerful reagent than has been generally supposed. The results, in brief, are as follows:

"First. Analcite, leucite, natrolite, and scolecite, heated with dry ammonium chloride to 350° in a sealed tube, yield alkaline chlorides and an ammonium aluminum silicate, which is stable at 300°. The reaction is simply one of double decomposition, the sodium or potassium of the original silicate being completely replaced by ammonium. Analcite and leucite give the same product, $NH_4AlSi_2O_6$. Natrolite and scolecite yield the salt $(NH_4)_2Al_2Si_3O_{10}$. The latter compound is a derivative of orthotrisilicic acid, $H_8Si_3O_{10}$; and in a separate section of the memoir its constitution and its relations to other trisilicic acids are considered."

"Second. A similar reaction, a double decomposition, takes place incompletely with stilbite, heulandite, chabazite, thomsonite, laumontite, and pollucite. Part of the monoxide base is removed and replaced by ammonium, without change of atomic ratios. Cancrinite is also vigorously attacked, and partially transformed into a zeolitic body."

"Third. Pectolite, wollastonite, apophyllite, datolite, ilvaite, and calamine are violently acted upon by ammonium chloride, and their molecules seem to be almost completely broken down. The products of the reactions are mixtures, and no ammonium silicates are formed."

"Fourth. Elaeolite, sodalite, riebeckite, olivine, serpentine, phlogopite, prehnite, orthoclase, albite, oligoclase, aegirite, pyrophyllite, leuchtenbergite, and xanthophyllite are but slightly attacked by dissociating ammonium chloride."

"In the closing section of the work we have shown that the ammonium chloride reaction may be appled to an approximate quantitative determination of analcite and leucite in rocks, thereby aiding somewhat in the estimation of their mineralogical composition."

W. F. HILLEBRAND.

The Crystallography of the Calcites of the New Jersey Trap Region. BY AUSTIN FLINT ROGERS. *School of Mines Quart.*, **23**, 336–347.—The concluding remarks of this crystallographic paper have a bearing on chemistry by showing the paragenesis of the various minerals produced by contact metamorphism of the trap with the sandstones and shales. The approximate order of formation seems to have been: Datolite, prehnite, calcite, heulandite, apophyllite, analcite, natrolite, stilbite. Calcite occurs in several generations; for instance, at Great Notch, a specimen of drusy calcite is distributed over minerals enclosing calcite.

W. F. HILLEBRAND.

The Concentration of Barium in Limestone. BY C. W. DICKSON. *School of Mines Quart.*, **23**, 366–370.—The particular case studied was an exposure of Trenton limestone in a quarry at Kingston, Ontario. The composition of the limestone, as ascertained by J. C. Murray, is shown by numerous analyses. Running from top to bottom of the exposure is a vein, 2 to 3 inches wide, of crystallized calcite and barite with disseminated pyrite. The source of the barium was sought by making many tests of the limestone for it and total sulphur.

These showed that the soil layers of decomposed limestone and glacial débris and the upper, more open and weathered, layers of the limestone carried appreciably more barium than the compact lower half, which yielded usually traces to a maximum, in the upper portion, of 0.25 per cent. BaO. The sulphur bore no relation to the latter and is mainly derived from sulphides. An undecomposed glacial boulder of anorthosite yielded 0.11 per cent. of BaO and others of augite syenite from 0.25 to 0.30 per cent. These are looked upon as the probable source of the barium in the limestone, since otherwise the compact layers of the latter should carry more than the upper, more permeable, ones. The possibility of the existence of barite as an original constituent of the limestone is not overlooked. "Most likely some of the calcite has been altered *in situ* to sulphate by the action of the oxidizing pyrite. This reacting with the barium bicarbonate in solution in the infiltrating waters, would cause its deposition as sulphate in its present position." W. F. HILLEBRAND.

On Bacubirito or the Great Meteorite of Sinaloa. BY HENRY H. WARD. *Proc. Rochester Acad. Sci.*, **4**, 67–74; *Am. Geologist*, **30**, 203–211; *Science*, **16**, 267 (Abst.).—The author has uncovered and described this hitherto little known, enormous, irregularly shaped mass of iron, estimated to weigh approximately 50 tons. Its dimensions are: length, 13 feet 1 inch; width, 6 feet 2 inches; thickness, 5 feet 4 inches. Its octahedral character is most marked. Acid produces beautiful Widmanstätten figures

of small pattern. Troilites are very scarce; sp. gr. 7.69. Analysis by J. E. Whitfield showed the following composition: Fe, 88.944; Ni, 6.979; Co, 0.211; S, 0.005; P, 0.154; Si, trace.

W. F. HILLEBRAND.

Occurrence of Corundum. JOSEPH HYDE PRATT in *The Production of Abrasive Materials*, advance extra (p. 45) from *Mineral Resources of the United States, Calendar Year 1901.*—In describing the various modes of occurrences of corundum a new one is noted, in a granitic rock in Fremont County, Colorado, about seven miles from Canyon. The accompanying feldspar is plagioclase instead of orthoclase as in the corundum-bearing syenites of Montana and Ontario. The artificial production of corundum from bauxite by heat and pressure in an electric furnace, as now carried out at Niagara Falls, is regarded (p. 56) as confirmatory of the author's previously expressed views regarding the origin of corundum in quartz schist in North Carolina.

W. F. HILLEBRAND.

On Some Modes of Occurrence of the Mineral Albertite. BY L. W. BAILEY. *Trans. Royal Soc. Canada, Vol. VII, Sec. IV,* pp. 77–83.—Several facts bearing on source, age, and method of accumulation of the deposits of albertite in Albert County, New Brunswick, have been gathered during late years and are fully discussed. They show that the mineral must be a vein deposit and have originated from a fluid condition.

W. F. HILLEBRAND.

Mineral Resources of Kansas, 1901 and 1902. BY ERASMUS HAWORTH. *Bull. Univ. Geol. Survey of Kansas.* pp. 78.—The analytical matter of this report is confined to analyses of coal from the Atchison Prospect Well (see this Review, **24**, 72).

W. F. HILLEBRAND.

Observations on the Eruptions of 1902 of La Soufriere, St. Vincent, and Mt. Pelee, Martinique. BY EDMUND OTIS HOVEY. *Bull. Am. Mus. Nat. Hist.*, **16**, 333–372, and *Am. J. Sci.*, **14**, 319–358.—The author's views as to the causes of death and destruction resulting from the repeated outbreaks of these volcanoes are essentially the same as those put forth by Jaggar (see this Review, **24**, 449), and, based as they are on long and thorough examination of the ground, are entitled to the most respectful consideration. An analysis, by the reviewer, of dust from the first eruption of the Soufrière, should be examined in connection with those in the *Nat. Geog. Mag.*, **13**, 296–299 (see this Review, **24**, 448). It illustrates in a marked degree the greater amount of sulphur in the ejecta from the Soufrière as compared with hose from Pelée, and "the absence of chlorine is interesting as

indicating fresh waters as the source of the steam of the eruptions."
W. F. HILLEBRAND.

Note on a New Occurrence of Native Arsenic. BY NEVIL NORTON EVANS. *Am. J. Sci.*, 14 397.--This is a vein of calcite, cutting nepheline syenite at Montreal, carrying apparently very pure arsenic, of which the yield has, thus far, been about fifty pounds.
W. F. HILLEBRAND.

Washington Geological Survey. *Vol. I. Annual Report for 1901.* 344 pp. In the preparation of this, the first volume of its kind issued by the State of Washington, the State Geologist, Henry Landes, has been assisted by Professors Solon Shedd, W. S. Thyng, and D. A. Lyon, of the Survey staff. The volume is divided into six parts, covering the following subjects: Outline of Geology of Washington; The Metalliferous Resources except Iron; The Non-metalliferous Resources except Coal; The Iron Ores; The Water Resources; Bibliography of Literature Referring to the Geology of Washington. There are a good many analyses of iron ores, limestones, and waters.
W. F. HILLEBRAND.

Mineral Resources of the U. S., 1901. 996 pp. BY DAVID T. DAY.—From this bound volume three of the reports issued during the past year as advance extras are missing. They are: "Peat," "Occurrence of Glass-Pot Clays," and "Utilization of Iron and Steel Slags," the second and third of which contained a number of selected analyses. The usual condensation and omission is to be found in several of the other papers. Attention may be called to the following points of interest not already noted in these abstracts.

The Production of Iron Ores, by John Birkinbine, contains the usual long list of cargo analyses of ores from the Lake Superior regions.

Greensand Marl, by Arthur L. Parsons, contains fifteen selected analyses of marls from New Jersey, Maryland, and Virginia.

Fuller's Earth contains analyses, by Heinrich Ries, of earth from Georgia and Florida with results of physical tests having regard to its adaptability for bleaching oils, and closes with a tabulated list of analyses of Fuller's earth from various domestic and a few foreign localities.
W. F. HILLEBRAND.

Mineral Waters [Kansas]. BY E. H. S. BAILEY. *The University Geol. Survey of Kansas, Vol. VII*, 343 pp.—Part I is devoted to a general discussion of mineral waters: Their sources, uses, therapeutics; brines; theory of solutions (by H. P. Cady); outline of methods of analysis, etc.; classification; prospecting

and boring (by H. P. Cady); artificial and carbonated waters. In Part II the waters are arranged and classified in groups according to composition, and the report closes with a short chapter by W. R. Crane on the geological distribution of mineral springs and wells.

The analyses are numerous and are compared frequently with those of well-known waters in other states and abroad. It is gratifying to note that preference is given to the ionic method of stating the results of analysis, though the amounts are given in grams per liter. To meet popular demand the results are repeated in the old form of statement, followed by the hypothetical combinations. W. F. HILLEBRAND.

ANALYTICAL CHEMISTRY.

The Detection of Hydrocyanic Acid in the Presence of Sulphocyanic, Hydroferrocyanic and Hydroferricyanic Acids and Their Salts. BY LOUIS E. PREISS. *Am. Chem. J.*, **28**, 240–241. —Heavy metals and alkaline earths are first removed by boiling with sodium carbonate. Caustic potash and aluminum filings are then added, whereby ferricyanides are reduced to ferrocyanides. When the reduction is complete, as shown by testing with ferrous sulphate, the solution is acidified with hydrochloric acid and the hydroferrocyanic acid present precipitated with an excess of mercuric chloride in the cold. The precipitate is separated by filtration. The filtrate is made alkaline with caustic potash and is again filtered to remove the mercury. To the alkaline filtrate ferrous sulphate is added and the solution is boiled. Any cyanides present are thus converted into ferrocyanides. The solution is again filtered, the filtrate acidified with hydrochloric acid, and ferric chloride added. By carefully decolorizing by mercuric chloride any sulphocyanate formed, the precipitate of prussian blue becomes apparent. If acidification is too strong, or if there is only a small amount of hydrocyanic acid present, the solution appears green and the precipitate of prussian blue appears only on standing. E. M. CHAMOT.

An Electric Lamp for Microscope Illumination. BY DR. M. M. METCALF. *Science*, **15**, June 13, 1902, 937–938.—"The essential features of this plan of illumination are the diffusion of the light......and having bulbs adapted for a voltage of from five to ten volts less than the current in use." The author obtains nearly pure white light by using forty-volt incandescent lamps on a fifty-volt circuit. The bulbs are ground glass and are mounted in an ordinary mirror-backed reading shade which is covered with a ground-glass front. E. M. CHAMOT.

The Educational Value of Photomicrography. BY ARTHUR CURTIS SCOTT. *Pop. Sci. Mo.*, 61, June, 1902, 143–156.—The author first discusses briefly the technique of photomicrography, such as the relative values of different cameras, objectives with and without eye-pieces, the efficiency of different sources of illumination, time of exposure, etc.

The great value of photomicrographs in the study of various scientific problems, in the illustration of books, lectures, etc., and their superiority over drawings is then emphasized.

E. M. CHAMOT.

A Method of Measuring Objects in the Microscope. BY FRED. E. IVES. *J. Frank. Inst.*, 154, 73–76.—The method proposed consists in projecting the image of a scale in the plane of the object, by means of the substage condenser. The scale is attached to the end of an adjustable wooden block at a point between the source of light and the microscope mirror. One end of the wooden block is notched in such a way as always to project in the same position when in place. The scale used by the author consists of a jeweler's saw having 64 teeth to the inch. The image of the saw teeth forms the measuring scale which can be given different values by changing the distance of the saw from the mirror. In place of a saw an engraved scale or other device may be used. The image is focused by racking the substage. The value of the scale at any given distance is determined by projecting the image in the plane of a stage micrometer. It is evident that in this method of micrometry the changing of eye-pieces or objectives does not affect the value of the scale.

E. M. CHAMOT.

Microscopic Examination of Paper Fibers. BY W. R. WHITNEY AND A. G. WOODMAN. *Tech. Quarterly*, 15, 272.—In this exhaustive article the authors give detailed descriptions of the appearance under the microscope of the various fibers used in the manufacture of papers. An analytical scheme has been arranged as an aid to the recognition of these fibers without the use of elective stains or reagents. The descriptions are accompanied by the reproduction of 82 photomicrographs of different fibers and by 12 of wood sections.

E. M. CHAMOT.

Determination of Corundum in an Ore. JOS. HYDE PRATT in *The Production of Abrasive Materials in 1901*, advance extra (p. 50) in *Mineral Resources of the United States, Calendar Year 1901*.—The method used with satisfactory results by Pratt and Boltwood, of New Haven, Conn., is in brief as follows: After crushing in an iron mortar, sifting through a 14-mesh sieve, and sampling, 2 grams of the material are digested with concentrated hydrochloric acid on the water-bath for two hours. The residue

is filtered, dried, and fused one-half hour with sodium and potassium carbonates (2 : 1) over a Bunsen burner. After cooling, the mass is leached with water, the solution decanted through a filter, the residue treated with much dilute hydrochloric acid, and the resulting solution decanted through the same filter. The ignited filter and residue are treated together with an excess of concentrated hydrofluoric acid, the excess of which is volatilized, the insoluble residue extracted with hot water, and then collected on a filter, ignited, and weighed as corundum.

W. F. HILLEBRAND.

A New Device for Stereoscopic Photomicrography. BY FREDERICK E. IVES. *J. Frank. Inst.*, **154**, 391.—The device described consists in an attachment to a camera of special construction (this Review, **8**, 485), whereby stereoscopic negatives can be obtained which are ready for direct printing. The attachment consists in the addition of three equilateral prisms mounted in a small box fastened to the front of the camera below the camera objective. Of these three prisms one, the smallest, is placed, base down, at the eye-point of the microscope ocular and serves to divide the rays. The other two larger prisms serve to project the divided rays upon the sensitive plate thus producing two stereoscopic images. In order to obtain an exactly divided field the prism box is capable of lateral motion. Amplifications of $\times$ 10 to $\times$ 120 with ordinary objectives and eye-pieces are best made with color sensitive plates and a yellow screen ; while with Zeiss 16 mm. apochromatic objectives and compensating eyepieces, ordinary plates may be used without color screens.

E. M. CHAMOT.

The Action of Carbon Dioxide upon the Borates of Barium. BY L. C. JONES. *Am. J. Sci.*, [4], **14**, 49–56.—The work of Morse and Burton and of Morse and Horn on the determination of boric acid is criticized in the light of results previously published by the author. It is concluded that carbon dioxide decomposes barium metaborate in either water or alcoholic solution and that the boric acid liberated may in part escape during the evaporation and subsequent heating. The method of Morse, Burton and Horn is said to give unreliable results.

H. N. MCCOY.

METALLURGICAL CHEMISTRY.

Technical Education. BY R. H. RICHARDS. *Age of Steel*, September 6, 1902.—Some advice on the preparation of young men for the foundry business. The modern foundries cannot afford to ignore the chemistry of their processes, nor metallography, nor pyrometric measurements. The technically educated stu-

dent, while he may not have dealt with the exact problems which come up in the foundry, has had a training in the direction of developing in him breadth of view, quickness of perception, mental alertness and adaptability, and the works which gets the right sort of man with a technical training will find great advantage in it. His familiarity with the literature saves time by finding out what others have done, and he is able therein to find suggestions for new work totally inaccessible to the uneducated man. J. W. RICHARDS.

Metallic Conduction and the Constitution of Alloys. J. A. MATHEWS. *Elec. World and Eng.*, Oct. 4, 1902.—Reviews Barrett's results, which showed that a relation exists between the increase of electrical resistance of a metal by alloying with small amounts of another metal, and the atomic weight of the metal added. Also Benedick's results, in which the resistance of steel was figured out, in micro-ohms per centimeter cubed, as 7.6 + 26.8 C, where C represented the percentage of carbon and all other foreign elements calculated as equivalent quantities of carbon. The writer urges that the question of solubility of one metal in the other seems to control or affect metallic conduction in alloys, and there exists an atomic relation between the effect of different dissolved substances upon the conductivity of the principal metal or solvent. Alloys, in many of their properties, resemble liquid solutions. J. W. RICHARDS.

Upon the Structure of Metals and Binary Alloys. BY W. CAMPBELL. *J. Frank. Inst.*, July, August, September, 1902.—This long, well-illustrated paper, deals with first the structure of metals and alloys in general, then the crystalline structure of metals; the effects of strain and heat-treatment are illustrated, and finally the various groups of binary alloys set forth, and the constitution of several representative examples studied in detail, the parallel between their cooling curves and microstructure being brought out in detail. The subject of practical metallography is discussed under the heads of (1) Preparation of the alloy or metal; (2) Preparation of the surface, cutting and polishing; (3) Etching the prepared surface, development of microstructure; (4) microscopical examination, mounting the specimen, microscope and accessories; (5) Microphotography. The details given under these headings alone, in this paper, constitute a very fair treatise on metallography. The crystalline structure of metals is dealt with at length, with fine photographs of the structure of cadmium, aluminum, silver and bismuth. The effects of strain are described in numerous cases, but reference is made for illustrations to Dr. Mathew's preceding paper before the Franklin Institute. Alloys are first considered under the caption of solutions of one metal in another, with interesting information as to the

separation of mixtures into their components in which each metal contains some of the other dissolved in it. The binary alloys are considered according to Charpy's classification, *viz.*, Class I, in which the metals form neither definite compounds nor isomorphous mixtures, or those in which the excess of either metal crystallizes out in a eutectic which is a mechanical mixture of the two metals. To this class belong the alloys Sn-Zn, Sn-Pb, Sn-Bi, Pb-Sb, Pb-Ag, Zn-Al, Cu-Ag, Cu-Au. Class II, those which form two eutectic mixtures, in between which will be found a definite combination; to this class belong Cu-Sb, Sn-Ni, Sb-Al. Class III, contain those which form isomorphous mixtures and in which, therefore, no eutectic exists; this class contains Bi-Sb, and Ag-Au alloys. Extensive discussions and diagrams are given of the alloys of Sn-Zn, Pb-Sn, Pb-Sb, Sn-Bi, Zn-Al, Ag-Pb, Sb-Cu, Sn-Ni, Al-Sb, Ag-Sn, Ag-Sb, Sn-Sb, Sn-P, Sn-As, Cu-Sn. J. W. RICHARDS.

Open Cut Mining on the Mesabi Ore Range. *Eng. Min. J.*, September 6, 1902.—Two striking illustrations of two important mines, the Mahoning and the Mountain, showing very clearly the method of working these unique deposits. The former is operated by concentric cuts, making a circular pit a mile in diameter by 150 feet deep, and with 100 feet of ore still beneath. The latter is operated by straight open cuts. The steam shovels load a 50-ton car in four minutes, and over 6,000,000 tons of ore have been taken from this one mine. J. W. RICHARDS.

Effect of Variations in the Constituents of Cast Iron. BY W. G. SCOTT. *Age of Steel*, September 6 and 13, 1902 (Paper read before Am. Sec. Intern. Assoc. for Testing Materials).—*Silicon*, from 1 to 4 per cent. is a softener; below 1 per cent. the iron is hard and chills, these qualities increasing, the lower the silicon. In general, 1 per cent. silicon will give $^1/_8$ inch chill, 0.70 per cent. $^1/_4$ inch chill, 0.5 per cent. $^5/_8$ inch, 0.40 per cent. 1 inch, 0.30 per cent. $1^1/_2$ inches. Silicon decreases shrinkage; every 0.20 per cent. increase of silicon corresponds to about 0.01 inch per foot decrease in shrinkage. Transverse strength increases up to 1.4 per cent. silicon, and then decreases; tensile strength increases up to 1.9 or 2 per cent. silicon, and above that decreases.

Sulphur, increases 0.03 to 0.05 per cent. on every remelting. It hardens iron, 0.01 per cent., offsetting the softening effect of about 0.15 per cent. silicon. It increases the strength up to 0.15 per cent. in low phosphorus irons, and to 0.095 per cent. in medium phosphorus iron, every 0.01 per cent. of sulphur, within those limits, increasing the tensile strength 50 pounds. Sulphur increases shrinkage and chill, every 0.03 per cent. sulphur cor-

responding to 0.01 inch per foot increase in shrinkage; it gives rise to blow-holes, and its influence is largely counteracted by manganese. With manganese 0.30 per cent. sulphur should not exceed 0.065; with manganese 0.60 per cent., sulphur may be 0.095.

Phosphorus lowers the melting-point, imparts fluidity, decreases shrinkage, weakens the iron and makes it cold short. One point (0.01 per cent.) of phosphorus is about equal to three points of silicon in decreasing shrinkage. The higher the combined carbon the lower the phosphorus should be; for ordinary gray iron the limit of safety is 0.70 per cent.; for thin, soft castings, up to 1.00 or 1.25 per cent. may be allowed; in chill castings, it should be under 0.30 per cent.

Manganese, above a certain point, hardens iron, increases shrinkage and chill, whitens the iron; within certain limits it softens iron and decreases shrinkage and chill, from its effect in neutralizing the sulphur. In remelting, 0.1 to 0.3 per cent. of manganese is lost. The strength of the iron increases up to 1.00 per cent. manganese; normal gray iron castings contain 0.40 per cent.

Carbon, is normally present as one-seventh graphitic and six-sevenths combined. Graphitic carbon opens the grain, reduces shrinkage and chill, and softens the iron; combined carbon hardens the iron, increases shrinkage and chill, imparts stiffness, closes the grain, increases the strength. Slow cooling favors the formation of graphitic carbon, as also the presence of much silicon and aluminum; fast cooling, much sulphur or manganese and low silicon favor the combination of the carbon. The writer concludes by the following summary:

To raise the strength: Reduce the graphite, phosphorus or silicon, or increase manganese or combined carbon. *To reduce shrinkage:* Increase graphitic carbon, phosphorus or silicon, or reduce the sulphur. *To prevent blow-holes:* Reduce sulphur or increase manganese. *To prevent kish:* Reduce graphite by increasing the amount of scrap used, or raise the manganese.

J. W. Richards.

Cupola Linings. By W. J. May. *Age of Steel*, September 20, 1902 (From *Mech. World*).—If arch bricks are not to be had, the bricks used should be cut or rubbed into shape. The cracks should be filled with finely-ground moistened fire-clay, the joints being as thin as possible. Ganister may be used for the zone of greatest heat, facing off the bricks. The tuyere openings should be cast-iron blocks projecting half an inch beyond the face of the lining; the cold blast keeps them from melt-

ing. A cast-iron ring is desirable on top of the lining, to prevent undue wear on the edges of the bricks by the charges thrown in. At least a week should be allowed for drying, then a coke or wood fire started. J. W. RICHARDS.

The "Thermit" Process for Producing Castings. *Age of Steel*, September 27, 1902.—The Goldschmidt process of producing melted iron for welding purposes is used to produce melted iron for castings. The ordinary sand mould is used for small castings, dried thoroughly and the surface painted well with graphite and water. A channel is provided outside the mould, in loose sand, for the slag and any superfluous iron to run into. Defects in castings are filled by placing an extemporized mould around the spot and pouring on the melted iron. Pieces can thus be melted on to castings or forgings. The mixture for producing the melt is thermit powder with scrap iron, placed in a refractory crucible with a small tap-hole in the bottom, covered by a wrought-iron punching and some dry sand on this—the whole standing above the mould. J. W. RICHARDS.

The Metallurgy of Titanium. BY AUGUSTE J. ROSSI. *J. Frank. Inst.*, 154, 241–261.—There are many immense deposits of titaniferous iron ores which are not worked owing to a belief that their metallurgy offers great difficulties. The author shows this belief to be erroneous. Ores containing as much as 30 to 35 per cent. of titanic acid are easily worked. The slag, composed of titanates of calcium, magnesium and aluminum, flows quite readily. The iron obtained is of good quality and contains but a fraction of one per cent. of titanium, this element not being reduced by carbon at the temperature of the blast-furnace. Ferrotitanium, made in the electric furnace, added to common pig improves its quality, not only on account of the beneficial effect conferred by the small amount of titanium left in the iron but because the former, like manganese, acts as a powerful deoxidizer. It may also, by combining with nitrogen, remove nitrides.

H. N. MCCOY.

Developments in the Electrometallurgy of Iron and Steel. BY M. RUTHENBURG. *Trans. Am. Elec. Chem. Soc.*, Vol. II, 1902.—The writer's proposition is to take magnetic concentrates and to frit them together into hard lumps by incipient fusion in an electric furnace, instead of briquetting. It is stated that 500 kilowatt hours will treat a ton of ore. If the ore is mixed with carbon it is reduced in the operation, and the resulting sponge can be used in open-hearth furnaces or welded to a muck bar. The cost is about $3.00 per ton of ore, for power alone, which puts its competition with briquetting out of question, but leaves

a better possibility of use in reduction by carbon to the metallic state. J. W. RICHARDS.

The Crofton Smelter, Vancouver Island. BY W. M. BREWER. *Eng. Min. J.*, September 6, 1906.—An illustrated description of the Northwestern Smelting and Refining Company's new smelter, the first on Vancouver. It is situated on the edge of deep water, with large unloading docks and ore-bins, and a sampling plant with a capacity of 1,000 tons daily. The furnace building contains a water-jacketed smelter with a capacity of 350 tons daily, a Garretson furnace of equal capacity, and a cupola for remelting matte. The Garretson is a new type of furnace, which will smelt with only 3 per cent of fuel and carry on converting also in the same operation. The converter building contains two vessels, having a capacity of 100 tons of matte daily. These are commanded by a 50-ton traveling electric crane. The assay office is the largest and most commodious in the West. Slag from the furnaces is granulated in water. The writer predicts a large business for the plant. J. W. RICHARDS.

Zinc Ore in Kentucky. *Eng. Min. J.*, September 13, 1902.—Since May, 1901, the Old Jim Mine, near Marion, in Crittenden County, is reported to have shipped 4,150 tons of calamine, from workings near the surface. Blende with fluorspar has been found in two other mines. This district is attracting considerable attention. A good process for mechanically separating the blendes from fluorspar is needed. J. W. RICHARDS.

The Sudbury Nickel Mines. BY SPECIAL CORRESPONDENT. *Eng. Min. J.*, September 20, 1902.—The Mond Nickel Company has opened up the Victoria Mine, in Denison, very systematically to a depth of over 500 feet in a massive body of good ore; they are also running three other mines, from one of which 60 tons of ore is being shipped daily. The Lake Superior Power Company has recently erected a smelting plant at the Gertrude Mine, where about 30,000 tons of ore are in the roast heaps, and one matte furnace has been running some weeks. Two other furnaces are being added, which will make the capacity 400 tons daily. This company is opening a new mine at Blue Lake, on the east end of the North Range, which is curiously situated in the crater of a small extinct volcano. Diamond drill tests have shown 100,000 tons of unusually high-grade ore within 136 feet of the surface. J. W. RICHARDS.

The Cinnabar Deposits of the Big Bend Province, Texas. BY R. T. HILL. *Eng. Min. J.*, September 6, 1902.—This district is rapidly increasing its product, and in the author's opinion may become one of our most important mercury producers. The

locality is less than eight square miles in area, in the southwest corner of Brewster county, about ten miles from the Rio Grande. The deposits occur upon the surface of narrow upthrown fault blocks of a large riff, and the mineralization is of a Mexican type, *i. e.*, the ore is in irregular bodies or pockets which are the result of replacement in a favorable matrix along lines of fissure which are so irregular and inconspicuous as to easily escape the miner's eye. Very high-grade ore, running 40 to 78 per cent., has been found in large pockets, the chief gangue being calcite; some native mercury is also found. The cinnabar is sometimes present in the country rock along the veins, but is invisible to the eye until the rock is crushed. The development of the district is proceeding as rapidly as circumstances will permit. The output in 1900 was 1,750 flasks, and in 1901, 3,400 flasks, each of 76 pounds. There are two 10-ton Scott furnaces at work, and one 50-ton. J. W. RICHARDS.

The Terlingua Quicksilver Deposits, Brewster County. *The University of Texas Mineral Survey, Bull. No. 4*, October, 1902, 74 pp.—Chapters I–VI, by B. F. HILL, treat of location, general conditions and history; geology and topography; deposits; mining and reduction; occurrence of ores—future possibilities; companies operating. Chapter VII, by WM. B. PHILLIPS, deals with the occurrence, production, prices, etc., of quicksilver. In this chapter appear three analyses of Brewster County coals, one, a lignite, from Cub Spring, the others, more bituminous, from the Kimble Pits and Chisos Pen. Numerous photographs, sections, and a map of the mining district accompany the report. A topographic map will follow. W. F. HILLEBRAND.

Report of the Bureau of Mines [Ontario], 1902. 309 pp. BY THOS. W. GIBSON.—Among the contents of this eleventh report may be mentioned the following papers with more of less of a chemical bearing, several carrying analyses or petrographical descriptions: *Statistics for 1901*, pp. 9–60; *The Mineral Industries of Saulte Ste. Marie*, pp. 91–100, by A. B. Willmott; *Arsenic in Ontario*, pp. 101–122, by J. Walter Wells; *Iron Ranges of Northwestern Ontario*, pp. 128–151, by A. P. Coleman; *The Michipicoten Iron Region*, pp. 152–185, by A. P. Coleman and A. B. Willmott; *The Eastern Ontario Gold Belt*, pp. 186–207, by Willet G. Miller; *Syenites near Port Coldwell*, pp. 208–213, by A. P. Coleman (see abstract in this Review, **24**, 450).

W. F. HILLEBRAND.

Use of Aluminum for Foundry Patterns. BY H. TUTTLE. *Al. World*, September, 1902.—Aluminum patterns are very much lighter than soft-metal patterns; they loosen more easily in the

sand, are stiffer and do not easily bend. They do not warp or shrink at all, like wood patterns, and are unaffected by dryness or moisture. In making them, they are cast in sand, as dry as will mould well, and the metal poured as cold as possible. The gate and sprue should be large, and gated at the heaviest part. The moulds should be rammed soft, and well vented. Aluminum nails can be used to stiffen projecting parts of the mould. Sand-paper wheels are used for finishing the surfaces. Such patterns have been in continual use in some foundries for six years, and are still as good as new, having become slightly discolored but smoother. J. W. RICHARDS.

Process of Purifying Alumina. *Al. World*, September, 1902. Account of an electric-furnace process recently patented by C. M. Hall, whereby the alumina to be purified is mixed with sufficient reducing material to reduce its impurities to the metallic state, and the mass given a preliminary heating to incipient fusion, in an electric furnace, whereby the oxide impurities are reduced to the metallic state, and the resulting carbon monoxide is driven off. The mass thus prepared is next melted completely, in another operation, and purified alumina and metallic alloy of the impurities obtained. The object of the preliminary treatment is particularly to get rid of the gases produced by the reduction, so that they are not evolved in the final process where fusion takes place, and where their evolution would tend to project parts of the charge from the furnace. J. W. RICHARDS.

Cathodic Reduction. BY A. T. WEIGHTMAN. *Trans. Am. Elec. Chem. Soc.*, Vol. II, 1902.—A discussion of the reduction of sulphides of lead, copper, nickel, and silver, to the metallic state, when used as cathodes in dilute sulphuric acid. Antimonial lead was used as anode. The gases coming off were analyzed for H_2S, H and O, and thus the course of the reduction followed. Lead sulphide, as galena in small pieces, gives off, at starting, pure hydrogen, but H_2S soon makes its appearance and increases to a maximum of 87 per cent. in an hour. With 4.8 amperes to 27 grams galena, as much as 94.6 per cent. of H_2S was in the gases. Reduction was practically complete in three hours. With Cu_2S, the proportion of H_2S started off at once at a maximum of 57.6 per cent., and thenceforth decreased. With Ag_2S, the proportion of H_2S started off at 92 per cent., rose to 98.4 per cent., and stayed there twenty minutes, giving perfect reduction in sixty minutes, using 7 amperes to 15 grams of sulphide. With NiS the reduction did not start for over five minutes, using 6 amperes to 15 grams of sulphide, set in at fifteen minutes with only 2.4 per cent. of H_2S in the gases, and gradually increased to a maximum of 32 per cent. in fifty minutes. The

discussion of the *why* of these reactions is interesting, Mr. C. J. Reed propounding the most plausible explanation, that the current divided between the sulphide and the plate on which it rested, in proportion to their conductivities, and that whenever the sulphide acted as a cathode it was necessarily decomposed.

J. W. RICHARDS.

The Electrolytic Dissolution of Soluble Metallic Anodes. BY W. McA. JOHNSON. *Trans. Am. Elec. Chem. Soc.*, Vol. II, 1902. —The writer advances the very plausible theory that the non-attack of certain constituents is not so much due to their essential insolubility in the acids generated at the anodes, but is more largely due to the fact that the particles of alloy are so much poorer conductors than the pure metal in which they are disseminated, that the current is more or less shunted around them, dissolving therefore the pure metallic background faster, and allowing the alloy to drop comparatively unattacked into the slimes. Several illustrations are described, and the writer seems to have opened up a new and very satisfactory explanation of some of the phenomena of electrolytic refining. J. W. RICHARDS.

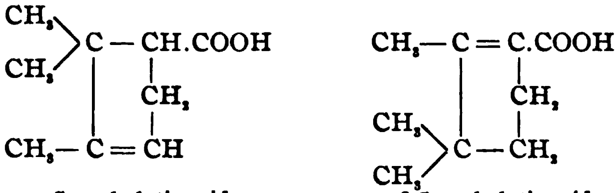
The Formation of Metallic Dust from Cathodes. BY F. HABER. *Trans. Am. Elec. Chem. Soc.*, Vol. II, 1902.—If lead or tin are used as cathodes in alkaline solutions, there is formed a dense gray cloud of metallic dust, which results in all probability from the preliminary alloying of the alkaline metal with the lead or tin and the subsequent decomposition of the alloy by the water present, forming caustic alkali and liberating the metal as dust. Some dust is also formed with lead and bismuth cathodes in acid solutions, and is then probably due to the formation of a hydride which is rapidly decomposed by the water.

J. W. RICHARDS.

ORGANIC CHEMISTRY.

Camphoric Acid (Eleventh Paper). **Confirmation of Bredt's Formula; Some Derivatives of Inactive Camphoric Acid.** BY WILLIAM A. NOYES AND AUSTIN M. PATTERSON. *Am. Chem. J.*, 27, 425–433.—Noyes has already shown (*Am. Chem. J.*, 23, 130) that, by carrying dihydro-β-campholytic acid through a certain series of reactions, 2,3,3-trimethylcyclopentanone may be obtained. It is now shown that similar treatment of the corresponding dihydro-α-campholytic acid produces a different ketone, which is probably 2,2,3-trimethylcyclopentanone, the oxime of which crystallizes from ligroin in plates melting at 104°. The α- and β-campholytic acids are, therefore, probably structural

isomers and not stereomers as previously suggested, their formulas being:

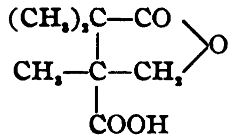


α-Campholytic acid. β-Campholytic acid.

A new and strong confirmation of Bredt's formula is thus furnished. The authors also point out that several facts have been observed in connection with the work upon the campholytic acids which appear to be at variance with current stereochemical theories. It is suggested that the oxime recently prepared by Blanc (*Bull. Soc. Chim.*, **27**, 71), from a ketone obtained from *α*-campholenic acid, and melting at 107°–108°, may be one of the optically active components of the racemic oxime obtained by the authors from dihydro-*β*-campholytic acid. *Derivatives of inactive camphor.*—The material used was the inactive camphor manufactured by the Ampére Electrochemical Co. from turpentine, and melting at 176°. By the action of nitric acid, it is oxidized to *i*-camphoric acid, m. p. 204°, and camphoronic acid. Acetic anhydride and acetyl chloride convert the *i*-camphoric acid into the anhydride, from which the imide was readily formed, the latter, in turn, being converted into *i-β-camphoramidic acid*, which crystallizes in needles, m. p. 178°. *i-Dihydroaminocampholytic acid*, HOOC. $C_8H_{14}.NH_2$, was prepared in the manner previously described (*Am. Chem. J.*, **16**, 503), for the active isomer, and crystallizes in leaflets closely resembling the latter. The *chloroplatinate* is easily soluble. The *anhydride*, $C_8H_{14}\!\left\langle\begin{matrix}CO\\ |\\ NH\end{matrix}\right.$, melts at 188°. The amino acid, when treated with sulphuric acid and sodium nitrite, decomposes into *i-dihydrohydroxycampholytic acid* and *racemic α-campholytic acid*. The hydroxy acid melts at 173°, not 176° as previously stated. The *i-α-campholytic* acid was obtained as a liquid. Its *amide* melts at 99°. When warmed with dilute sulphuric acid, the acid is changed to *β*-campholytic acid.

M. T. Bogert.

Camphoric Acid (Twelfth Paper). **Synthesis of Trimethylparaconic Acid.** By William A. Noyes and Austin M. Patterson. *Am. Chem. J.*, **28**, 228–232.—By the interaction of trioxymethylene, sodium trimethylsuccinate and acetic anhydride, in a sealed tube at 120°–140°, there was obtained a clean synthesis of *trimethylparaconic acid*,



The acid may be crystallized from benzene or from dilute alcohol; it melts, with decomposition, at 256°–257°; warmed with excess of sodium hydroxide, it yields the sodium salt of *trimethylitamalic acid*, $(CH_3)_2C(COONa)C(CH_3)(CH_2OH)(COONa)$. By the action of ethyl iodide upon the silver salt of the latter, the *diethyl ester* was prepared as a viscous oil, which did not solidify. The ethyl ester of bromtetramethylsuccinic acid, $(CH_3)_2C(COOC_2H_5)C(CH_3)(CH_2Br)(COOC_2H_5)$, could not be obtained by the action of phosphorus tribromide upon the trimethylitamalic ester, the product being in every case the *ethyl ester of trimethylparaconic acid* (from loss of ethyl bromide). This same ester was prepared from the trimethylparaconic acid, alcohol and hydrochloric acid gas, in a sealed tube at 100°; its m. p. is 34.5°. It is hoped that the extension of this work may lead to the synthesis of Bredt's camphoric acid. M. T. BOGERT.

Action of Phosphorus Pentachloride on Aniline. BY J. ELLIOTT GILPIN. *Am. Chem. J.*, 27, 444–454.—In a previous paper (*Am. Chem. J.*, 19, 352) the author described compounds $PCl_3(NC_6H_5)$ and $PCl(NHC_6H_5)_4$; the former obtained from phosphorus pentachloride and aniline chloride, the latter from phosphorus pentachloride and aniline. A further study of the latter substance leads to the conclusion that it is not a single substance, but a mixture. In addition to the above compounds, by the action of phosphorus pentachloride upon aniline under different conditions, the author has obtained two other substances, $P(NC_6H_5)_2(NHC_6H_5)$ and $P_2Cl(NHC_6H_5)_7$. The former was prepared by conducting the reaction in benzene solution and at a low temperature; it is insoluble in water but dissolves in alcohol, crystallizing from the latter in clear well-defined orthorhombic crystals, containing no water of crystallization and melting sharply at 208°–210° (uncorr.). (The crystals are figured and crystallographic data given.) It also crystallizes in tufts of soft hair-like needles, and is quite stable, being unchanged when heated with water in a sealed tube for six hours at 175°, or when heated with alcoholic potash solution. Aqueous potash or concentrated hydrochloric acid have no action, but concentrated sulphuric acid dissolves it with production of sulphanilic acid, and fuming nitric acid decomposes it. The compound $P_2Cl(NHC_6H_5)_7$ is best prepared by adding phosphorus pentachloride to boiling aniline, but even then the yield is very small. The crystals resulting from slow evaporation of a cold alcoholic solution carry alcohol of crys-

tallization and tend to become dull in the air from loss of this alcohol. The powder left after the removal of this alcohol melts at 192°–194°, is very slightly soluble in cold alcohol, and appears to change to $PCl(NHC_6H_5)_4$ when boiled with alcohol. (Illustrations are given of many of the crystals, with measurements of angles, etc.) M. T. BOGERT.

A New Method for the Preparation of Unsaturated Hydrocarbons. BY J. ELLIOTT GILPIN. *Am. Chem. J.*, 27, 494–495.—A report upon the method recently described by Ipatiew (*Ber. d. chem. Ges.*, 34, 3579 (1901), and 35, 1047 (1902)) for producing unsaturated hydrocarbons by passing alcohol vapors through tubes filled with scraps of graphite crucibles and heated to 600°. M. T. BOGERT.

On *p*-Azoxybenzaldehyde. BY F. J. ALWAY. *Am. Chem. J.*, 28, 34–48.—Kirpal has described a *p*-azoxybenzaldehyde melting at 194°; Lucius and Brüning have a patented *p*-azoxybenzaldehyde which melts at 180°; and Gattermann has obtained a substance which he believes may be the anhydride of *p*-hydroxylaminebenzaldehyde, and which melts at 190°. The investigations reported in the present paper show that the substances obtained by Kirpal and by Gattermann are identical. EXPERIMENTAL.—*The electrolytic reduction of p-nitrobenzaldehyde* was carried out as described by Gattermann, the first product of the reduction being the *N-p-formylphenylether of p-nitrobenzaldoxime*, while the secondary reduction product is a *red substance* which does not melt below 330°, but appears to decompose at 220°–230°. This red substance is insoluble in ordinary organic solvents, including carbon bisulphide, nitrobenzene, pyridine, phenol and naphthalene, but dissolves in concentrated sulphuric acid from which it may be reprecipitated by dilution with ice water; boiled with dilute sulphuric, or with hydrochloric or glacial acetic acids, it is decomposed with production of *p*-azoxybenzaldehyde; by oxidation with ferric chloride solution, *p*-nitrosobenzaldehyde and *p*-azoxybenzaldehyde are formed, but no *p*-nitrobenzaldehyde. Oxidation of the primary reduction product, however, with the same reagent gives in addition to the *p*-nitroso- and *p*-azoxybenzaldehyde, also the *p*-nitrobenzaldehyde. *p-Azoxybenzaldehyde*, $ON_2(C_6H_4COH)_2$, was prepared from the primary and secondary reduction products of the *p*-nitrobenzaldehyde, from *p*-nitrosobenzaldehyde, and also by the action of zinc dust upon *p*-nitrobenzaldehyde according to the method of Kirpal. *p*-Nitrosobenzaldehyde and the *N-p*-formylphenylether of *p*-nitrobenzaldoxime, by the action of phenylhydrazine, are changed to the hydrazone of *p*-azoxybenzaldehyde. *p-Azoxybenzaldehyde*, crystallized from acetic acid and then from

benzene, melts at 190°. It forms long yellow needles, slightly soluble in hot water, cold alcohol and ligroin, more soluble in boiling ligroin; readily soluble in benzene or glacial acetic acid. It is unchanged by boiling with dilute sulphuric or with hydrochloric acid, by warming to 100° its solution in concentrated sulphuric acid, by boiling with concentrated nitric acid, by the action of acetyl or benzoyl chloride, or when heated with acetic anhydride in a sealed tube at 100°. Oxidized by chromic acid in glacial acetic solution, it gives a *gray substance*, insoluble in ordinary solvents, and probably *p*-azoxybenzoic acid, while the action of zinc dust and acetic acid produces *red crystals* of unknown nature. Kirpal's work was repeated and his product shown to be identical with the material obtained by Gattermann from the *N-p*-formylphenylether of *p*-nitrobenzaldoxime, both being apparently *p*-azoxybenzaldehyde. In the repetition of Kirpal's process, a *substance* was separated which crystallized from acetic acid in red needles, m. p. 222°, and which was not further investigated. *p-Azoxybenzaldehydephenylhydrazone*, $ON_2(C_6H_4CH : NNHC_6H_5)_2$, may be obtained by the action of phenylhydrazine upon *p*-azoxybenzaldehyde, *N-p*-formylphenylether of *p*-nitrobenzaldoxime, or upon *p*-nitrosobenzaldehyde. It crystallizes from benzene or pyridine in orange-colored leaflets, which melt at 228° when heated rapidly, or decompose at 218°–225° if heated slowly; slightly soluble in boiling alcohol, much more so when the hydrazone of *p*-nitrobenzaldehyde is present. *p-Azoxybenzylideneaniline*, $ON_2(C_6H_4CH : NC_6H_5)_2$, prepared by boiling the aldehyde with excess of aniline, crystallizes from benzene in large yellow leaflets, m. p. 185°–192°, difficultly soluble in ether, alcohol, ligroin and cold benzene, readily soluble in hot benzene. *Nitro-p-azoxybenzaldehyde*, $(HOC)(NO_2)C_6H_3.ON_2.C_6H_4COH$, prepared by the action of fuming nitric acid upon the aldehyde, crystallizes from glacial acetic acid in yellow needles, m. p. 171°–172°, insoluble in water, slightly soluble in ether or cold alcohol, readily soluble in hot acetic acid. *p-Azoxybenzalchloride*, $ON_2(C_6H_4CHCl_2)_2$, from the interaction of the aldehyde and phosphorus pentachloride, crystallizes from ligroin in orange-colored leaflets, m. p. 115°–116°. The action of phenylhydrazine upon the *N-p*-formylphenylether of *p*-nitrobenzaldoxime in alcoholic solution yields the corresponding *hydrazone*, $O_2N.C_6H_4.\overbrace{CH.N}^{O}.C_6H_4.CH : N.NHC_6H_5$, which crystallizes from pyridine in dark red leaflets, m. p. 222°, insoluble in ether, benzene, acetone, carbon bisulphide or cold alcohol, slightly more soluble in boiling alcohol or glacial acetic acid. At the same time there are formed the hydrazones of *p*-azoxybenzaldehyde and of *p*-nitrobenzaldehyde (m. p. 155°). If the reaction be carried out in aqueous

solution only the two latter are produced. The *anilide of p-aldehydohydrazobenzene*, $C_6H_5NHNHC_6H_4CH : NC_6H_5$, is obtained by the action of aniline upon the *N-p*-formylphenylether already mentioned. It crystallizes from benzene in orange-colored leaflets, m. p. 183°–186°, dissolves but slightly in ligroin, alcohol or acetone, but very readily in hot benzene. *Action of p-nitrosobenzaldehyde with concentrated sulphuric acid.*—The solution of the aldehyde in concentrated sulphuric acid, when poured into ice water, separates a *red precipitate* which, when washed with water and recrystallized from glacial acetic acid, has the appearance of a dark red powder, m. p. 204°–206°, and is insoluble in water, ether or ligroin, slightly soluble in hot benzene, hot alcohol or cold glacial acetic acid, but easily soluble in the latter when heated. This substance will be further investigated. *Benzenazobenzylidenaniline*, $C_6H_5N : NC_6H_4CH : NC_6H_5$, was prepared by boiling for a few minutes a mixture of *p*-nitrosobenzaldehyde, aniline and acetic acid. Recrystallized from ligroin, it forms small orange-colored needles, m. p. 125°–130°, but slightly soluble in cold alcohol, ligroin or benzene, more readily in boiling ligroin, very soluble in hot alcohol or benzene. *Benzenazobenzaldehyde*, $C_6H_5N : NC_6H_4COH$, was prepared from the latter compound by the action of boiling dilute acetic acid. It crystallizes from alcohol, or from dilute acetic acid, in brownish red glistening leaflets, m. p. 116°, but slightly soluble in cold alcohol and ligroin, more soluble in benzene, glacial acetic acid or hot alcohol. Its *hydrazone* crystallizes from glacial acetic acid in long red needles, m. p. 154°. By a process similar to that outlined above for the preparation of the *p*-azoxybenzaldehyde from the *p*-nitro compound, the *m*-nitro aldehyde has been converted into an *aldehyde* melting at 129°, which yields a *hydrazone* melting at 198°.

M. T. Bogert.

A Contribution to the Chemistry of the Aromatic Glutaric Acids. By S. Avery. *Am. Chem. J.*, **28**, 48–59.—*β-p-Tolylglutaric acid* (with H. C. Parmelee). *p*-Tolylacrylic ester was condensed with sodium malonic ester and the resulting carboxylic ester saponified by hydrobromic acid. Transparent oblique prisms, m. p. 165°–167°, soluble in acetic ester, hot water or chloroform, less soluble in ether, practically insoluble in benzene, petroleum ether and in water at 0°. Salts were prepared by precipitation of the ammonium salt. *Silver salt*, white amorphous powder; *copper salt*, green crystalline powder; *calcium salt*, white crystalline powder. By heating the acid above its melting-point, or by treating it with hot acetyl chloride, the *anhydride* is obtained in feathery crystals, m. p. 153°. The latter substance, when heated with aniline in benzene solution, gives the *anilic acid;* glistening white needles (from alcohol), m. p. 194°–196°. A *silver salt* was

prepared. If the anilic acid be heated above its melting-point, it yields the *anil;* long sharp needles (from alcohol), m. p. 174.5°. *β-m-Nitrophenylglutaric acid* (with M. C. Gere). Prepared by condensing *m*-nitrocinnamic ester with sodium malonic ester, saponifying the resulting tricarboxylic ester with hydrobromic acid. It is a nearly white crystalline solid, m. p. 205°–206°, easily soluble in alcohol or ether, less soluble in water, very little soluble in benzene, chloroform or petroleum ether. *Silver salt*, white amorphous powder ; *calcium salt*, white crystalline precipitate ; *barium salt*, white crystalline precipitate ; *copper salt*, green amorphous powder. *Anhydride*, obtained by the action of acetic anhydride upon the acid, forms white silky crystals, m. p. 170.5°, insoluble in benzene and petroleum ether, but dissolves in alcohol with regeneration of the free acid ; insoluble in water and scarcely attacked by it. *Anilic acid*, white flaky crystalline solid, m. p. 160°, soluble in alcohol, insoluble in petroleum ether or benzene. Its *silver salt* is fairly stable when dried below 100°, but at 120° rapidly blackens ; it is not very readily affected by light. *β-p-Nitrophenylglutaric acid* (with H. T. Beans).—By the direct nitration of *β*-phenylglutaric acid the para and ortho nitro derivatives result, at 8°–10° the product being mainly the para acid, while at higher temperatures more ortho is formed, the yield of the latter apparently increasing steadily with increase in the strength of the acid and rise of temperature. *β-p*-Nitrophenylglutaric acid forms nearly colorless hard short prisms, m. p. 237°, soluble in alcohol, ethyl acetate or glacial acetic acid, very difficultly soluble in hot water or benzene, insoluble in chloroform, ether or ligroin. *Silver salt*, white amorphous solid ; *calcium salt*, white solid ; *barium salt*, white silky solid. *Anhydride*, produced by the action of acetic anhydride upon the free acid, clear crystals, slightly yellow (from acetic ether), m. p. 122.5°; not easily attacked by water, soluble in acetic ether, difficultly soluble in hot benzene, insoluble in cold benzene, dissolves in hot dilute alcohol with regeneration of the free acid. The *dimethyl ester*, obtained by passing hydrochloric acid gas into the methyl alcohol solution of the anhydride, forms large plates, nearly colorless (from alcohol), m. p. 62°, insoluble in water, very soluble in alcohol. *Anilic acid*, light glistening flakes, m. p. 120°–121°. Its *silver salt* is white and gelatinous, stable at 120°, and not readily blackened by light. By heating the anilic acid, the *anil* is produced, fine white needles, m. p. 203°, soluble in acetone or glacial acetic acid. The by-product in the nitration of *β*-phenylglutaric acid, probably *β-o-nitrophenylglutaric acid*, separates from its hot aqueous solutions in fine light yellow crystals, m. p. 175°, which were not further investigated. M. T. BOGERT.

On the Action of Ethylene Dibromide on Paranitrosodimethylaniline. By Henry A. Torrey. *Am. Chem. J.*, **28**, 107–121.—By the interaction of ethylene dibromide and *p*-nitrosodimethylaniline there is produced *p*-nitrosodimethylaniline hydrobromide and a body consisting of two molecules of the base united by an ethylene residue, which the author calls dinitrosodimethylanilinethylene, $(ON.C_6H_4.N(CH_3)_2)_2C_2H_4$, the hydrocarbon residue being united with the NO groups and not with the amine nitrogen. Experimental.—*The action of ethylene dibromide on p-nitrosodimethylaniline. Di-p-nitrosodimethylanilinethylene*, as produced in this reaction, crystallizes from amyl alcohol in deep red needles, decomposing at 230°–240°, soluble in chloroform or glacial acetic acid, very slightly soluble in alcohol, insoluble in water; very easily soluble in dilute mineral acids, apparently with decomposition, since it cannot be reprecipitated by neutralizing. A *picrate* was prepared in chloroform solution. The dinitroso compound may be reduced by zinc and acetic acid, or by sodium amylate in amyl alcohol solution. In the latter case, one of the products is tetramethyldiaminoazoxybenzene. The latter is also formed when the dinitroso body is heated with the chloride of *p*-nitrosodimethylaniline in alcohol solution, or when the free *p*-nitrosodimethylaniline is heated for a considerable time with alcoholic ethylene dibromide. A chloroform solution of the dinitroso compound gives precipitates with iodine or bromine; very dilute nitric acid decomposes it with production of *p*-nitrosodimethylaniline nitrate and a reduction product. *p-Nitrosodimethylaniline hydrobromide.* Bright yellow crystals (from methyl alcohol), decomposing at 207°. The *chloroplatinate of p-nitrosodimethylaniline*, obtained as a crystalline precipitate, appears to be different from the platinum compound described by Schraube (*Ber. d. chem. Ges.*, **8**, 616). *The action of an alcoholic solution of ethylene dibromide on p-nitrosodimethylaniline.* If the mixture is boiled for some time, the red ethylene derivative first formed is decomposed with partial reduction of the nitroso groups and formation of tetramethyldiaminoazoxybenzene. *Picrate of di-p-nitrosodimethylanilinethylene;* yellow crystals, melting with decomposition at about 155°; somewhat soluble in chloroform, very slightly soluble in ether; by dissolving in hot alcohol it is dissociated into the red free base and picric acid; warm water precipitates the free base, picric acid remaining in solution; by neutralizing with sodium hydroxide the free base may be recovered. The *picrate of p-nitrosodimethylaniline* crystallizes from water in rectangular plates decomposing at about 140°, soluble in cold alcohol, slightly soluble in glacial acetic acid or chloroform, still less so in benzene, insoluble in ether, much more soluble in hot water than in cold; sodium carbonate liberates the base again.

The action of dilute nitric acid on di-p-nitrosodimethylanilinethylene. By the addition of the ethylene derivative to dilute nitric acid, insoluble *p*-nitrosodimethylaniline nitrate is precipitated (m. p. 162°). In the filtrate there is found a *substance* which crystallizes from alcohol in yellow plates, m. p. 255°–256°, which dissolves very readily in dilute mineral acids, giving colorless solutions, but its solution in glacial acetic acid is blue; its chloroform solution is colored a beautiful deep blue by very small amounts of bromine or chlorine. It appears to contain no oxygen. Formic acid is also present in the filtrate. Mr. C. W. Whitney assisted in part of the experimental work.

M. T. BOGERT.

On the Preparation of Aromatic Guanidines. BY FREDERICK J. ALWAY AND CAREY E. VAIL. *Am. Chem. J.*, **28**, 158–164.—The study of the phenyl and tolyl derivatives of guanidine was undertaken to ascertain, among other things, the influence of substituting groups upon the course of reactions in which guanidines are formed. EXPERIMENTAL.—*Preparation of thioureas.* Diphenylthiourea is easily obtained by shaking together carbon bisulphide (5 parts), aniline (5 parts), and sulphur (1 part), the reaction being complete in fifteen minutes; the sulphur is dissolved out by carbon bisulphide, or the carbon bisulphide is evaporated off and the residue crystallized from alcohol. The best reagent to desulphurize thioureas is freshly precipitated and thoroughly washed lead hydroxide. *Preparation of guanidines.* Equal molecules of thiourea and amine are dissolved in alcohol, the solution heated to boiling on a water-bath, treated with excess of lead hydroxide, the solution filtered and the precipitate extracted with boiling alcohol. The alcoholic solution is cooled by ice water and treated with a slight excess of concentrated nitric acid, causing the precipitation of the guanidine nitrate in crystalline form, which is purified by recrystallization, dissolved in alcohol and the base liberated by dilute potassium hydroxide. In the preparation of phenyldi-*o*-tolylguanidine, a small amount of tri-*o*-tolylguanidine was also formed, while in the preparation of diphenyl-*p*-tolylguanidine no other guanidine was detected. The yield of nitrate by this method was usually 75 to 90 per cent. of the theoretical. *Diphenyl-p-tolylguanidine nitrate* was obtained in equally good yield from diphenylthiourea with *p*-toluidine or from phenyl-*p*-tolylthiourea with aniline. Small colorless plates, m. p. 196°–197°, readily soluble in hot alcohol, slightly soluble in cold alcohol or in hot water, very slightly soluble in cold water. The nitrates of the following bases have been obtained by the general method given above—*diphenyl-m-tolyl*, *phenyldi-p-tolyl*, *o-tolyldi-p-tolyl*, *m-tolyl-di-p-tolyl*, *di-o-tolyl-p-tolyl*, *di-o-tolyl-m-tolyl*, and *phenyl-o-tolyl-p-tolyl* guanidine.

M. T. BOGERT.

On the Aromatic Guanidines. BY FREDERICK J. ALWAY AND FREDERICK W. VIELE. *Am. Chem. J.*, **28**, 292–297.—An investigation of the formation of guanidines and diguanides, in the hope of finding some relation between the course of the reaction and the structure of the reacting diimide or amine. *Pentaphenyldiguanide,*

$$\left(\begin{matrix} C_6H_5.NH \\ C_6H_5.N \end{matrix}\!\!>\!\!C-\right)_2N.C_6H_5.$$

Twelve grams of diphenylcarbodiimide, mixed with 3 grams of aniline, in alcoholic solution, yielded 8 grams of impure pentaphenyldiguanide. Eleven grams of β-diphenylcarbodiimide fused with 3 grams of aniline, gave only 1.5 grams of the diguanide. *Tetraphenyl-p-tolyldiguanide,*

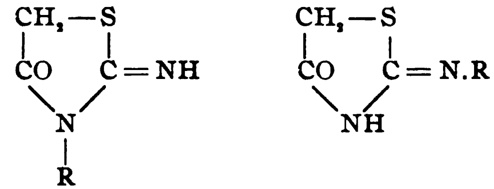
$$\left(\begin{matrix} C_6H_5.NH \\ C_6H_5.N \end{matrix}\!\!>\!\!C-\right)_2N.C_7H_7,$$

can be prepared from diphenylcarbodiimide and *p*-toluidine, or by the action of *p*-toluidine and lead hydroxide upon diphenylthiourea, the yield being smaller in the latter case. Diphenyl-*p*-tolylguanidine is formed in the same reactions, probably from the gradual decomposition of the diguanide. *Tetraphenyl-m-tolyldiguanide* and *diphenyl-m-tolylguanidine* result from the action of *m*-toluidine upon diphenylcarbodiimide. The diguanide melts at 136° (not sharply), is readily soluble in acetone or benzene, much less so in boiling absolute alcohol, sparingly soluble in ether, ligroin, cold absolute alcohol, or in boiling aqueous alcohol; its *chloride* forms a white crystalline mass; its *chloroplatinate* is a flesh-colored mass, melting at 140° with decomposition, readily soluble in alcohol, insoluble in water. *Diphenyl-m-tolylguanidine,* $(C_6H_5NH)_2C:N.C_7H_7$, is best obtained by the action of *m*-toluidine and lead hydroxide upon diphenylthiourea, purification of the crude base by conversion to the nitrate, and decomposition of the pure nitrate by potassium hydroxide. Stellate groups of colorless needles (from alcohol), m. p. 132°, very soluble in hot absolute alcohol or in hot benzene, soluble in aqueous alcohol or in ether, insoluble in water. Its *nitrate* forms hard, colorless crystals, melting with decomposition at 179°, readily soluble in hot alcohol, sparingly soluble in cold alcohol or in water. *Chloride*: colorless plates, m. p. 195°, slightly soluble in cold water, readily in cold alcohol. *Chloroplatinate*: orange-red leaflets, m. p. 237°.

M. T. BOGERT.

On the Molecular Rearrangement of Thiocyanacetanilides into Labile Pseudothiohydantoins; and, on the Molecular Rearrangement of the Latter into Stable Isomers. BY HENRY L. WHEELER AND TREAT B. JOHNSON. *Am. Chem. J.*, **28**, 121–

158.—The mechanism of the reactions yielding pseudothiohydantoins has never been satisfactorily explained, and the structure of the products has also been a matter of considerable uncertainty. The thiocyanacetanilides of Grothe (*Arch. Pharm.*, **238**, 615 (1900)) were prepared, and the phenyl-*o*-tolyl and *p*-tolyl compounds found to be rhodanides, while the so-called "rhodanacet-*p*-toluid" is a labile pseudothiohydantoin, and the "rhodanacet-*p*-phenetidid" a stable pseudothiohydantoin. The pseudothiohydantoins are assigned the following formulas:



Labile. Stable.

Chloracetanilide and potassium thiocyanate, warmed together in strong alcoholic solution, give the normal thiocyanacetanilide (m. p. 91°); the latter substance, fused dry for a short time, yields the labile phenylpseudothiohydantoin (m. p. 148°); and, by continuing the heating, the latter is then changed into the stable form (m. p. 178°). In view of the formula established for the stable pseudothiohydantoin, the structure assigned by Langlet (Beilst., Spl. Bd. II, 200 to 3-phenyl-2-imino-4-acitetrahydro-1,3-azthin should be altered. The behavior of the labile products with alkali leads to the conclusion that there are three metastatic changes involved in the rearrangement and two structurally different labile thiohydantoins. Three reactions have been observed on treating thiocyanacetanilides and labile hydantoins with cold alkali: (1) molecular rearrangement into the stable form, (2) formation of hydantoic acids, and (3) decomposition into substituted cyanamides and thioglycollic acids. EXPERIMENTAL PART. *Normal thiocyanacetanilide*, $NCS.CH_2CONHC_6H_5$, fine colorless needle-like prisms, m. p. 91°, but the melting-point varies considerably with the manner of heating; crystallizes from alcohol in plates, m. p. 86°–88°; from benzene, in large thin transparent scales, carrying benzene of crystallization, which they lose on standing and then become opaque. Heated with thiacetic acid in benzene solution, *acetylthioglycollanilide*, $CH_3COSCH_2CONHC_6H_5$, is obtained, and crystallizes from alcohol in colorless needle-like prisms, m. p. 97°–98°. The same substance may be obtained from chloracetanilide and sodium thiacetate. In the reaction using thiacetic acid, there were also found, in certain cases, the stable hydantoin, what appeared to be an *acetyldithiourethane*, crystallizing from alcohol in fine hairy needles, m. p. 192°, and

a *dithiourethane*, $H_2NCSSCH_2CONHC_6H_5$, crystallizing from alcohol in colorless square plates, m. p. 162°. By the action of cold alkali upon thiocyanacetanilide, *phenylthiohydantoic acid*, $C_6H_5N:C(NH_2)SCH_2COOH$, is formed, and can be precipitated by carbon dioxide as a colorless crystalline precipitate, melting at about 185°–190° with decomposition. When thiocyanacetanilide is fused for a short time it passes into the *labile phenylpseudothiohydantoin* (α-keto-μ-imino-N-phenyltetrahydrothiazole), square orthorhombic tables (from benzene), of a pale yellow color, or acicular crystals (from a mixture of benzene and petroleum ether), melting at 148° with formation of a blood-red liquid. (The crystals are figured and crystallographic data given). *Hydrochloride* melts with effervesence at 192°–193°. *Picrate*, bright yellow prisms (from alcohol), m. p. 180°. When the labile hydantoin is treated with thiacetic acid in benzene solution, colorless needle-like prisms of α-keto-μ-acetimido-N-phenyltetrahydrothiazole (m. p. 191°–192°) are obtained. The same substance was also obtained by the action of acetic anhydride upon the rhodanide, the labile or the stable hydantoin. Cold sodium hydroxide decomposes the labile hydantoin with formation of phenylthiohydantoic acid, while, if heated alone to 165°, it changes to the *stable phenylpseudothiohydantoin*. The latter forms triclinic crystals (which are figured, with angle measurements, etc.), m. p. 178°; *chlorhydrate*, colorless needles (from alcohol), melting at 203° with decomposition, insoluble in benzene; *sodium salt*, colorless plates (from water). The stable hydantoin is not acted upon by thiacetic acid; with acetic anhydride or acetyl chloride it yields a *diacetyl derivative*, crystallizing from benzene in flat prisms, m. p. 161°–162°, from which the hydantoin can be recovered by the action of alkali; by the combined action of alcoholic alkali and benzyl chloride, a *benzyl derivative* is formed identical with that obtained from the unsymmetrical benzylphenylthiourea, $C_6H_5(C_7H_7)NCSNH_2$, and ethylchloracetate, and crystallizing from alcohol in square tables, m. p. 124°–125°. *Normal thiocyanacet-o-toluide*, $NCSCH_2CONHC_6H_4CH_3$, from the corresponding chlorine derivative and potassium or ammonium thiocyanate, forms colorless needles (from dilute alcohol), m. p. 102°–103°; on warming in ether solution, or by repeated crystallization from benzene, the m. p. becomes 109° and the crystals more prismatic (the crystals can be sublimed); with thiacetic acid, an *acetyldithiourethane*, $CH_3CONHCSSCH_2CONHC_6H_4CH_3$, results, forming needles or a white, sandy powder, very difficultly soluble in alcohol, and melting with effervescence near 200°; with thiobenzoic acid, the product is *benzoylthioglycoll-o-toluide*, $C_6H_5COSCH_2CONHC_6H_4CH_3$, which was also prepared from the chloride and potassium thiobenzoate, colorless or pale-yellow long

needles (from alcohol), m. p. 141°–142°; with alkali, *o-tolylcyanamide* is formed (m. p. 77°). By the continued action of heat, the rhodanide passes into the *labile o-tolylpseudothiohydantoin*, small colorless lozenge-shaped crystals (from benzene), m. p. 131°–132°, and *o tolylthiohydantoic acid*. The latter appears as a white powder or small thin plates, m. p. 208°–230°, insoluble in benzene, and can also be obtained from chloracet-*o*-toluide and potassium thiocyanate. Fusion of the labile form changes it to the *stable o-tolylpseudothiohydantoin*, long needles or stout tables, m. p. 144°–145°. This same substance can be prepared from *o*-tolylthiourea (m. p. 162°, and not 155° as given in the literature) and chloracetic acid, or from chloracet-*o*-toluide and potassium thiocyanate; acetic anhydride gives a *diacetyl derivative* in stout six-sided tables (from alcohol), m. p. 91°–92°, very soluble in benzene, insoluble in cold alkali. *Normal thiocyanacet-p-toluide*, from chloracettoluide and potassium thiocyanate, needle-like prisms, melting at about 85°; with thiacetic acid, a *dithiourethane*, $CH_3C_6H_4NHCOCH_2SSCNH_2$, is produced. Fusion of the rhodanide converts it to the *labile p-tolylpseudothiohydantoin*, colorless needles (from absolute alcohol), m. p. 125°–126°. The latter substance is also produced when solutions of the chloride and potassium thiocyanate are warmed on the water-bath for half an hour. By the action of thiacetic acid or acetic anhydride, the labile substance is changed to an *acetyl derivative*, $C_{12}H_{12}O_2N_2S$, colorless plates (from alcohol), m. p. 175°–176°; treated with alkali, it gives *p-tolylthiohydantoic acid*, as a cream-colored, crystalline powder, insoluble in water, very difficultly soluble in alcohol, decomposing at about 210°–212° with effervescence. By the continued action of heat, the labile isomer is rearranged to the *stable p-tolylpseudothiohydantoin*, needles (from alcohol), m. p. 183°, difficultly soluble in benzene, and which can also be obtained by concentrating the aqueous alcoholic filtrates from the preparation of the labile derivative. *Sodium salt*, thin plates or lozenge-shaped spangles; *diacetyl derivative*, $C_{14}H_{14}O_3N_2S$, from the action of acetic anhydride upon the stable hydantoin, pale yellow prisms (from alcohol), m. p. 163°–164°. *Labile α-o-xylylpseudothiohydantoin* (?), from the chloracetyl derivative of *o*-xylidine and potassium thiocyanate, colorless plates (from benzene), m. p. 111°; by the action of thiacetic acid, *α-keto-μ-α-o-xylyliminotetrahydrothiazole* is obtained, pale yellow needles (from dilute alcohol), m. p. 179°, soluble in alkali. *α-o-Xylylthiohydantoic acid* is obtained by evaporating the filtrate from the labile hydantoin and warming the residue with water: colorless microcrystalline substance, melting at about 208° with decomposition, insoluble. *Normal thiocyanacet-p-xylidide* (CH_3:NH:CH_3 :: 1:2:4), from the chloracetyl derivative (m. p. 153°) and potassium thio-

cyanate, colorless plates (from benzene), m. p. 133°. Thiacetic acid converts it to *acetylthioglycoll-p-xylidide*, $CH_3COSCH_2CONHC_6H_3(CH_3)_2$, colorless prisms (from alcohol), m. p. 139°–140°; while caustic soda gives *p-xylylcyanamide*, flat prisms, m. p. 118°. By slow fusion of thiocyanacet-*p*-xylidide, *p*-xylylthiohydantoic acid and the stable hydantoin are formed. *Labile p-xylylpseudothiohydantoin*, produced by boiling the corresponding rhodanide in dry ether for one or two hours, forms needles (from benzene), m. p. 109°–110°; alkali gives *p*-xylylcyanamide, but it does not react readily with thiacetic acid. *p-Xylylthiohydantoic acid* is obtained when alcoholic solutions from the rhodanide are diluted and evaporated on the steam-bath. It decomposes at about 200° with effervescence, and yields *p*-xylylcyanamide with alkali. *Stable p-xylylpseudothiohydantoin* is obtained by evaporating the alcoholic extracts from the above hydantoic acid, or by long boiling of the rhodanide in alcoholic solution; minute prisms (from benzene and petroleum ether), m. p. 161°–162°, quite soluble in alcohol and dissolving unchanged in alkali. *Labile p-phenetylpseudothiohydantoin*, from the chloracetyl derivative and potassium thiocyanate, melts at 128°; warmed with thiacetic acid, a *monacetyl derivative* is produced, needles or prisms (from alcohol), m. p. 155°; continued fusion changes it to the stable form. *p-Phenetylthiohydantoic acid*, obtained on concentrating the aqueous alcoholic filtrates from the rhodanide (which was not isolated pure) and labile hydantoin, is an insoluble powder, decomposing with effervescence at about 212°, and dissolves unchanged in alkali. *Stable p-phenetylpseudothiohydantoin* is precipitated from the alcohol and benzene extracts of the crude hydantoic acid by adding petroleum ether. It is a white powder, m. p. 163°–164°, very soluble in alcohol and benzene, and agrees in every respect with the substance heretofore regarded as the rhodanide. M. T. BOGERT.

The Action of Light on Cinnamylidenemalonic Acid. BY ELMER P. KOHLER. *Am. Chem. J.*, **28**, 232–240.—An investigation of a reaction first observed by Liebermann (*Ber. d. chem. Ges.*, **28**, 1440). I. *Method of exposure.*—An aqueous solution of sodium cinnamylidenemalonate is poured into an excess of dilute hydrochloric acid, and the finely divided acid thus separated and suspended in the liquid is exposed to direct sunlight, the action being complete in twenty to thirty hours. The acid is thus changed to a substance which crystallizes from glacial acetic acid in small white lustrous prisms, melting sharply at 195° and decomposing soon after; readily soluble in alcohol and acetone, moderately soluble in glacial acetic acid, almost insoluble in ether, chloroform or ligroin. Its molecular weight corresponds to a condensation of two molecules of the cinnamylidenemalonic acid,

$(C_{12}H_{10}O_4)_2$. Alkaline potassium permanganate oxidizes it to α-truxillic acid, benzoic acid, an oily acid and oxalic acid. The condensation product is, therefore, regarded as *diphenyltetramethylenebismethylenemalonic acid*,

$$\begin{array}{l} \qquad\qquad\quad C_6H_5.CH.CH.CH:C(COOH)_2 \\ \qquad\qquad\qquad\qquad\quad | \quad\;\; | \\ (HOOC)_2C:CH.CH.CH.C_6H_5 \end{array}$$

Sunlight causes no similar condensation in the case of the sodium or acid potassium salts, methyl or ethyl esters, or amide of cinnamylidenemalonic acid. II. *Addition reactions with diphenyltetramethylenebismethylenemalonic acid.*—1. *With hydrochloric acid.* A methyl alcohol solution of the acid saturated with hydrochloric acid, separates the insoluble *methyl ester of an acid* formed by the addition of two molecules of HCl. This ester, $C_{28}H_{30}Cl_2O_8$, is almost insoluble in methyl and ethyl alcohols, chloroform or ether, readily soluble in boiling acetone, crystallizing from the latter in thick needles, which melt at 197°–198° with evolution of hydrochloric acid; the *ethyl ester* is rather more soluble in boiling alcohol than the methyl ester, and forms long slender needles (from acetone or absolute alcohol), melting with decomposition at 185°, very slightly soluble in ether, chloroform, methyl alcohol or cold absolute alcohol, moderately soluble in boiling alcohol, readily soluble in acetone. 2. *Addition of bromine.* Two molecules of bromine are easily taken up with formation of a very unstable addition product, crystallizing in clear lustrous plates, which easily lose CO_2 and HBr, passing into *diphenyltetramethylenebisbrommethyleneacetic acid*,

$$\begin{array}{l} \qquad\qquad\qquad C_6H_5.CH.CH.CBr:CH.COOH \\ \qquad\qquad\qquad\qquad\qquad | \quad\;\; | \\ HOOC.CH:CBr.CH.CH.C_6H_5 \end{array}$$

This forms colorless plates, melting with decomposition at 245°, insoluble in chloroform and ligroin, slightly soluble in ether and benzene, readily in alcohol or acetone; alkaline potassium permanganate oxidizes it to α-truxillic acid, this probably being the easiest way to prepare the truxillic acid, as all the reactions, beginning with cinnamylidenemalonic acid, are quantitative; *methyl ester*, m. p. 115°, moderately soluble in methyl alcohol, readily in alcohol or acetone. *3. Addition of $KHSO_3$.* The acid combines in the cold with a saturated solution of acid potassium sulphite to a compound from which dilute hydrochloric acid precipitates an *acid salt*, $C_{24}H_{22}O_{14}S_2K_2.6H_2O$, in fine white needles, moderately soluble in cold water, readily in boiling, insoluble in alcohol. The corresponding *neutral salt* is very easily soluble in water. *III. Change of diphenyltetramethylenebismethylenemalonic acid into cinnamylidenemalonic acid.*—By dissolving the tetramethylene acid in cold concentrated sulphuric acid and pouring

the yellow solution into ice water, pure cinnamylidenemalonic acid is precipitated. M. T. BOGERT.

On the Acids of the Fat of the California Bay Tree. BY J. M. STILLMAN AND E. C. O'NEILL. *Am. Chem. J.*, **28**, 327.—In 1882 the authors published (*Am. Chem. J.*, **4**, 206) an investigation of the fatty acids of the seeds of the California Bay Tree, presenting evidence of the existence of an acid $C_{11}H_{22}O_2$ (umbellulic acid). Later examination of this substance, however, indicates that the acid so separated was really a mixture, one of the constituents being lauric acid. M. T. BOGERT.

On an Acid Derivative of Ethyl Anilinomalonate. BY RICHARD SYDNEY CURTISS. *Am. Chem. J.*, **28**, 315–326.—By the action of nitrous acid upon ethyl anilinomalonate, the author previously obtained an oil of acid properties to which was tentatively assigned the formula of an ethyl α-phenyloxydiazomalonate,

$$\begin{array}{l} C_6H_5N.C(COOC_2H_5)_2 \\ \quad\;\; |\,/ \\ \quad\;\, NOH \end{array}$$

This substance has since been prepared in larger amount and studies made of its potassium, sodium and ammonium salts, the effect of heat upon it, and the action of acetic anhydride. Reduction with zinc and acetic acid was found to yield ethylanilinomalonate with evolution of ammonia. The electrical conductivity and the rapidity of salt formation with alcoholic potassium hydroxide were also determined. Ferric chloride solution colors it deep red, and it does not give the Liebermann nitroso reaction. EXPERIMENTAL. — The purified product from the action of nitrous acid upon ethylanilinomalonate is a thick clear amber oil, slightly reddish by transmitted light, and of bitter taste; it is easily soluble in benzene, ether, alcohol, chloroform or glacial acetic acid, very slightly soluble in ligroin or in water, easily dissolved by strong bases with the formation of a yellow solution, slowly attacked by sodium carbonate solution, readily decomposed by heat and sunlight with production of a thick red oil, quickly decomposed by slight traces of impurities. Tests of the electrical conductivity of the oil and of its potassium salt indicate that the former possesses the properties of a true acid. *Sodium salt*: canary-yellow needles, easily soluble in alcohol or acetic ether, fairly soluble in ether or water, slightly in chloroform; slow heating at 70°–100° causes decomposition; when quickly heated it melts at 118°–122°; its aqueous solutions soon break up, yielding a clear light-yellow oil of sweet penetrating odor, which decomposes in a short time separating colorless *needles*, melting near 112°. *Potassium salt*: fine crystals (from dilute solutions) resembling orthorhombic sulphur, and melting at 118°–120° (with evolution of gas)

when quickly heated; easily soluble in water or absolute alcohol, slighly soluble in chloroform or benzene, insoluble in ligroin; when dry and pure, will keep for some time; easily decomposed in aqueous solution, giving the same products as the sodium salt. *Ammonium salt*: light-yellow substance, easily soluble in water or ether, much less stable than the sodium or potassium salts. *The effect of heat upon the acid oil* is to decompose it with evolution of gases, and the production of a thick red neutral oil which is non-volatile *in vacuo*. *Crystals* separate from the latter on cooling, and when recrystallized from alcohol, melt at 111°. The purified substance forms white silky needles, neutral, insoluble in cold water or caustic soda, slightly soluble in hot water and in hydrochloric acid, fairly soluble in alcohol or ether, easily in acetone or benzene. The oily mother-liquor from these crystals, treated with aniline, ether, and hydrochloric acid, gave yellowish white *needles*, m. p. 110°–111°, which were not identified. *The action of acetic anhydride upon the acid oil*, heating the mixture under a return condenser, gives the same substance (m. p. 111°–111.5°) as obtained by the action of heat alone, nitrogen, nitric oxide and carbon dioxide being given off during the reaction; the odor of acetic ether was also noted, indicating the splitting off of an ethoxy group. In one experiment a neutral substance was obtained, similar in crystalline appearance to the above (m. p. 111°), and which was easily soluble in chloroform, ether, acetone and benzene, slightly soluble in hot water or in alcohol, insoluble in ligroin and in cold caustic soda; slightly soluble in boiling caustic potash, with apparent saponification (m. p. 114°), and with a molecular weight corresponding to that of an *acetyl derivative*. *Reduction of the acid oil* by zinc and acetic acid yields ethylanilinomalonate in greenish white monoclinic crystals (m. p. 44°), easily soluble in alcohol, ether, chloroform, acetone, or benzene, fairly soluble in ligroin, insoluble in water, reduces ammoniacal silver nitrate solution, and is oxidized by mercuric oxide to ethyl dianilinomalonate. Reduction experiments were also carried out with sodium amalgam. In one case, a yellow crystalline body was obtained, soluble in acids, caustic soda or water. The nitrogen was always split out as ammonia in these reductions. Electrolytic reduction proved unsatisfactory.
M. T. BOGERT.

On 2,6-Dibrom-*p*-phenylenediimine (Preliminary Communication). BY C. LORING JACKSON AND D. F. CALHANE. *Ber. d. chem. Ges.*, 35, 2495–2496.—The authors treated an ethereal solution of 2,6-dibrom-*p*-phenylenediamine with bromine and obtained a green precipitate, resembling oxide of chromium, which was immediately decomposed by water or alcohol, and which they believe to be the *hydrobromide of 2,6-dibrom-p-phenyl-*

enediimine, $C_6H_2Br_2(NH)_2.HBr$. Reducing agents readily change this to the bromide of the corresponding diamine. By the action of bromine and water, a substituted quinone is produced. Alkali changes the bromide to a brownish red base, which is still more unstable. An ethereal solution of *p*-phenylenediamine treated with bromine, gives a dark-blue hydrobromide, probably the corresponding diimine, $C_6H_4(NH)_2.HBr$, from which alkali liberates a brownish red bromine-free base. *o*-Phenylenediamine, when similarly treated, gives still more unstable products, while the meta compound yields a white precipitate, which is probably a substitution product. M. T. BOGERT.

BIOLOGICAL CHEMISTRY.

The Present Position of Chemical Physiology. BY W. D. HALLIBURTON. *Pop. Sci. Mon.*, 62, 27–41.—The very rapid growth and great importance of this field of science is discussed at length. Among other things, the work of Loeb on the value of ions in fertilization ; the knowledge gained of the constitution of the proteid molecule ; the discoveries of Pawlow on the various digestive secretions ; the theories of Ehrlich and his colleagues on the subject of immunity towards toxines, etc., are treated with in this paper. F. P. UNDERHILL.

The Results of Examinations of the Blood for the Widal Reaction Performed at the Diagnosis Laboratory of the Department of Health of New York City during 1901. BY JOHN S. BILLINGS. *N. Y. Med. J.*, 76, 715–717.—The great majority of the specimens consisted of drops of blood dried down on glass slides. In this Department of Health there must be well-marked clumping and death of the bacilli (evidenced by loss of motility) within ten minutes when the serum or blood is diluted twenty-fold, in order for the reaction to be called positive. Of the 1908 specimens examined, 304 showed a positive reaction. The best and most certain reaction is obtained when the disease has run one week. In 164 cases whose reaction seemed to be doubtful 33 proved to be typhoid, while 39 more were proved not to be typhoid. The remainder were not reported. 111 whose reaction seemed either negative or doubtful, all proved to be typhoid.
F. P. UNDERHILL.

Subcutaneous Injections of White of Eggs. BY HOLMES C. JACKSON. *N. Y. Med. J.*, 76, 813–814.—This article is especially concerned with the value of subcutaneous injections of egg white from a nutritive standpoint. It is shown that such injections can furnish no real nutrition to the body since egg white injected directly into the blood appears unchanged in the urine. It is,

therefore, certain that subcutaneous injections would be without value. Moreover, as the egg always contains bacteria, such injections are not advisable from a standpoint of health.

F. P. UNDERHILL.

Recent Progress in Pharmacology and Physiological Chemistry. BY M. VEJUX-TYRODE. *Boston Med. and Surg. J.*, 147, 488–491.—Being a review of the most important researches carried out in this country and abroad. Among many other features the value of alcohol as a food is especially discussed, and evidence is shown that it must be so regarded. F. P. UNDERHILL.

Comparative Toxicity of Ammonium Compounds, a Study in Auto-Intoxication. BY B. K. RACHFORD AND W. H. CRANE. *N. Y. Med. News*, 81, 778–784.—The animals used in these experiments were ordinary house mice. The relative toxicity of the various compounds was determined by injecting from a carefully graduated syringe a sufficient quantity of 5 per cent. solutions to produce death, and the lethal dose of each salt for a mouse of average size was in this way carefully established. The most toxic of the common ammonium salts examined was ammonium oxalate, and the least toxic ammonium lactate. One fact that is clearly brought out is that when the ammonium ion is united with an organic acid it largely loses its toxicity. The sodium compounds are practically non-toxic. Of the common potassium salt potassium carbonate is the most toxic, and potassium acetate the least toxic. Magnesium when combined with a sulphate ion has about the same degree of toxicity as the ammonium salt, but when combined with a chloride ion, it is more toxic. Calcium when combined with acid ions has a very slight degree of toxicity. Sulphuric, nitric, phosphoric, and hydrochloric acids are comparatively non-toxic.

F. P. UNDERHILL.

A New Method for the Determination of Urea in the Urine. I. BY OTTO FOLIN. *Zeit. f. physiol. Chem.*, 32, 504–515.—This method which is very short and accurate is as follows: 3 cc. of urine, 20 grams of magnesium chloride and 2 cc. of concentrated hydrochloric acid, are heated in an Erlenmeyer flask (200 cc. content) under a reflux tube (200 mm. × 10 mm.) until the condensing drops in the tube fall back into the mixture with a hissing sound. The heating is then continued for twenty-five to thirty minutes. The fluid is diluted with water, transferred to a liter flask, and the ammonia, after the addition of 7 cc. of 20 per cent. sodium hydroxide, is distilled. Usually about 350 cc. of fluid must be distilled (which takes about an hour) before all the ammonia has been distilled over. The distillate is boiled, cooled and titrated. Every cubic centimeter of N/10 ammonia found in

the distillate corresponds to 3 mg. or 0.1 per cent. urea. The corrections for the ammonium content of the magnesium chloride and for the pre-formed ammonia of the urine must be taken into consideration. F. P. UNDERHILL.

On the Quantitative Determination of Urea in the Urine. II. BY OTTO FOLIN. *Zeit. f. physiol. Chem.*, 36, 333–337.—In this article a few modifications are added to the method for the determination of urea in the urine as given by Folin in a previous paper (see *Zeit. f. physiol Chem.*, 32, 504–515), and also preceding abstract. Instead of heating for thirty minutes, as is advised in the first paper, it is safer to heat for forty-five to sixty minutes in order to be certain that all the urea has been decomposed. There is no danger of other nitrogenous compounds being decomposed. A small piece of paraffin, about twice the size of a coffee-bean, added to the mixture prevents the great foaming. In order to prevent loss of hydrochloric acid, the short condensing tube is employed, but in some cases this does not suffice. A tube of particular structure and size has been made by Folin which will prevent both loss of ammonia and hydrochloric acid. After the heating, the still hot fluid is transferred to a distillation flask, and the ammonia distilled off after the addition of a little alkali. The distillation lasts at least an hour. The necessity for this long distillation arises from the fact that a part of the urea is split into cyanuric acid. This cyanuric acid is, during the distillation, quantitatively split up into ammonia and carbon dioxide, but only slowly. F. P. UNDERHILL.

The Importance of Sodium Chloride in Heart Activity. By DAVID J. LINGLE. *Am. J. Physiol.*, 8, 75–99.—The strips of heart used in these experiments were obtained from the ventricle of the turtle. Sodium chloride is absolutely necessary for the origination of rhythmic activity in such heart strips. Agencies like caffeïn that can intensify rhythmic activity cannot originate it. What has been described as the sodium chloride arrest is probably due to a lack of oxygen in the salt solutions. The presence of oxygen in these postpones its development, and starts the rhythms again. Ordinary salt solutions do not contain enough oxygen for normal activity of the heart strips. Oxygen gas and sodium chloride, if properly used, will keep strips beating as long as a mixture of salt solution. Oxygen gas has a powerful influence on rhythmic power, but is of itself powerless to originate rhythms. Oxalate solution that precipitates calcium will permit beats to begin, if sodium chloride is present.

F. P. UNDERHILL.

The Behavior of Nucleated Colored Blood-Corpuscles to Certain Haemolytic Agents. BY G. N. STEWART. *Am. J. Physiol.*

8, 103–139.—The behavior of fowl's blood to ammonium chloride and sodium chloride shows that nucleated blood corpuscles, like non-nucleated, exercise a marked preference for ammonium chloride as compared with sodium chloride. This is the case even when the blood has been treated with formaldehyde. The preference is equally marked in stale and in fresh blood. In bird's blood, therefore, as in mammalian blood, the preference does not depend on the life of the corpuscles. Saponin produces a notable increase in the conductivity of fowl's blood, as it does in the conductivity of dog's blood. An equal, or greater, increase is produced in both kinds of blood, when saponin is added after the blood has been hardened by formaldehyde. This shows that the increase of conductivity is not dependent on, or associated with, the escape of the haemoglobin from the corpuscles. As in the case of mammalian blood, the increase of conductivity is due to an increase in the permeability of the corpuscles to electrolytes. The conductivity of fowl's blood is diminished by dilution with water to a much smaller extent than would be the case if serum or a solution of electrolytes were correspondingly diluted. This is due to the participation of the electrolytes of the corpuscles in the conduction of the current after the addition of water. Here, too, there is evidence that the electrolytes of the corpuscles participate in the conduction. Heat-laking of fowl's blood is caused at about the same temperature as that of mammalian blood. The conductivity of fowl's blood may be markedly diminished by heat-laking, unlike that of mammalian blood. The nucleated colored corpuscles of the blood of the mammalian embryo behave in the same way as the non-nucleated corpuscles of the adult, to most of the laking agents investigated. (Sapotoxin, sodium taurochlorate, amyl alcohol, water, foreign serum.) All the haemoglobin-containing elements of the red bone marrow of a young mammal behave in the same way as the adult mammalian, colored blood corpuscles to the agents investigated. Intraglobular crystallization of necturus blood is very readily obtained by the action of various haemolytic agents. The observations on this point show that the haemoglobin cannot exist in the corpuscles in ordinary aqueous solution. The various laking agents do not cause similar changes in the shape and size of the corpuscles and their nuclei. This indicates the existence of differences in the nature and point of attack of the fixation by different hardening agents. The permeability of the colored corpuscles for ammonium chloride does not depend on a toxic effect of the salt on the corpuscles. F. P. UNDERHILL.

Notes on the Action of Acids and Acid Salts on Blood-Corpuscles and Some Other Cells. BY S. PESKIND. *Am. J. Physiol.*, 8, 99–103.—If to defibrinated human blood, dog's blood,

cow's blood, or the blood of a chicken, there is added a very small quantity of most acids or the acid salts of iron, aluminum, zinc, copper, mercury, tin, silver, gold, uranium, and molybdenum, an immediate agglutination and precipitation of the blood corpuscles takes place. Neutral salts are unable to produce this reaction. The serum plays no part in this reaction, and the reaction is due to an effect of the reagents on the stromata of the corpuscles. The constituents of the stromata are lecithin, cholesterin, and a globulin. Neither the lecithin nor the cholesterin are concerned in the reaction, and, therefore, the alkali-globulin must be the cause of the phenomenon. The reagents which precipitate the stromata are also precipitants of alkali-albumin and alkali-globulin. A slight excess of the reagent causes precipitation of the corpuscles, but lakes them very rapidly. More than a slight excess of the reagent prevents agglutination and precipitation of the corpuscles. Leucocytes are strikingly agglutinated and precipitated by the same reagents which act upon red corpuscles. Spermatozoa are agglutinated and precipitated by ferric chloride, although the reaction was not obtained with copper sulphate or hydrochloric acid. Yeast cells show marked agglutination and precipitation, if they are suspended in saline solution and then treated with a little ferric chloride. A fungus rubbed up in saline solution gave a suspension of mycelia and spores which under the microscope showed practically no clumping. On the addition of ferric chloride, a flocculent precipitate, consisting of agglutinated masses of mycelia and spores, came down. Ciliated epithelium cells from the larynx of a rabbit, suspended in saline solution, are agglutinated and precipitated by ferric chloride. A solution of peptone in 0.9 per cent. saline was inoculated with a motile bacillus. After several days the bacteria were centrifugalized. The bacilli, suspended in saline, were immediately agglutinated and precipitated by small amounts of either ferric chloride or hydrochloric acid. F. P. UNDERHILL.

SANITARY CHEMISTRY.

Black Rain in North Carolina. CHARLES BASKERVILLE AND H. R. WELLER. *Science*, 15, 1034 (1902).—An analysis of the "famous black rain" so-called by the natives, that fell at Louisburg, N. C., on the morning of March 15, 1900, gave the following results: Parts per million, total residue, 88.00; loss on ignition, 54.00; non-volatile residue, 34.00; chlorine, 19.144; oxygen consumed in fifteen minutes, 1.93; in four hours, 2.64; free ammonia, 0.872; albuminoid ammonia, 0.04; nitrogen as nitrates, 0.88; nitrogen as nitrites, none. The organic matter, about 60 per cent. of the total residue, was largely soot, and the amount of

salt shown by the chlorine figure, is unusually large. No special phenomena were noted preceding or during the heavy downpour, except a darkness necessitating the use of lamps for one-half hour or more. The situation of the place, the amount of fuel burnt, as well as the time of year, preclude accounting for the rain by local contamination, and though sources of contamination may often be traced great distances, no cause for the above phenomenon has been found.

LEONARD P. KINNICUTT.

Sewage Disposal Works at Nuneaton, England. BY J. S. PICKERING. *Eng. Record*, **46**, 1902, pp. 319-320.—For many years the method of sewage purification at Nuneaton was chemical precipitation and artificial filtration. The results were unsatisfactory and the working expenses were very high and, several years ago, it was decided to make a trial of the bacterial system with septic tanks and contact beds. Although the sewage contained a large amount of trade waste from the works of wool scourers, felt mongers, and hat factories, the trial was so successful that the treatment is now applied to all of the sewage with satisfactory results and a considerable saving in working expenses. The plant consists of three covered tanks, built on the Dortmund principle, 34 feet deep and 24 feet in diameter; seven first contact beds, filled with broken granite, $2^1/_2$-inch guage; seven contact beds filled with screened coke dust, and 6c acres of land upon which the effluent from the second contact beds is distributed. The effluent from the second contact beds passes through 18-inch stoneware pipes, laid below the ground, and rises at intervals of 30–40 yards into chambers, to be distributed over the land.

LEONARD P. KINNICUTT.

The Prevention of Electrolysis of Gas and Water Pipes in Great Britain. BY W. H. HUMPHREYS. *Eng. News*, **48**, 1902, pp. 273–274.—A review of the steps taken to prevent electrolysis of gas and water pipes, and the regulations that have been secured by the British Board of Trade.

Sanitary Progress. SIR ALEXANDER A. BINNIE. *Eng. Record*, **46**, 1902, pp. 302–303.—This is an address given by the President of the Section of Engineering and Architecture of the Sanitary Institute at the annual meeting held at Manchester, England. It describes at length, Sewage Treatment, Purification of Water, The Prevention of Fogs, and the Housing of the Poor; shows the improvement that has been made in the past and what may be hoped for in the future.

LEONARD P. KINNICUTT.

Municipal Sanitation. By A. Prescott Folwell. *Eng. Record*, **46**, 1902, pp. 372. The author first takes up the subject of vital statistics, shows the importance of such statistics and the necessity of greater attention being paid to the subject than is done at present. The need of this, he states, is illustrated by the statement in the Report of the Wisconsin State Board of Health for 1900, "that, practically, our vital statistics, so far as they are made to the different registrars of deeds of the different counties, are absolutely useless, and that in Massachusetts, distinguished for its advance in sanitary matters, 1 town of more than 5,000 population, 14 between 1,000 and 5,000, and 66 of less than 1,000 population, failed to report any vital statistics in 1900." The author then takes up and discusses the following subjects: The Prevention of the Smoke Nuisance; Food Inspection; Disposal of the Dead; Abbatoirs and Markets; Public Fountains, Baths, and Convenience Stations; Drainage and Earth Excavations. Leonard P. Kinnicutt.

Residential Septic Tanks. By Burton J. Ashley. *Eng. Record*, **46**, 1902, pp. 346–347.—In this paper the author tells the lesson he learnt from observing the action of a cesspool at his own home, and how, from knowledge thus obtained, he has planned for the sewage disposal of Zion City on Lake Michigan. In this city no waste from kitchen sinks, water closets, bath-tubs, laboratories, nor wash or waste waters of any description are permitted to enter directly any sewer or drain, without having been first discharged into properly constructed septic tanks, located in a suitable position on the premises. The septic tank thus used must be built after plans approved by the board of health. The plan of tank adopted, is circular, generally 3 feet in diameter and 3 feet from the under side of the outlet to the bottom of the tank. The inlets and outlets to these tanks are placed on opposite sides, are made 4 inches in diameter, placed at the same elevation and enter the tank with a turn-down elbow; the bottoms of the tanks are made of concrete, the walls of brick; the interior below the discharge pipe is washed with four coats of pure cement wash; the capacity of the tanks are varied according to the number of people whose waste passes into them, but for the most part they contain 160 gallons.

Leonard P. Kinnicutt.

Residential Septic Tanks. By Benjamin H. Flynn, Engineer State Board of Health of Ohio. *Eng. Record*, **46**, 1902, p. 400.—In a letter to the *Engineering Record*, Mr. Flynn states that he does not agree with the ideas advanced by Mr. Ashley. He says: As desirable as it is to include the individual septic tank in the scheme of sewage disposal for isolated residences and institu-

tions, it is hardly advisable or economical to adopt this system for a city or village, where it is necessary to use a sewer system to carry off the effluent from the various septic tanks. There is also serious objection to the location of a septic tank in every yard, for although—"It is possible to construct water-tight tanks of brick and concrete, it is difficult, and requires considerable care. That this care will be used in the construction of every tank is extremely doubtful, and so there will ensue the use of leaky tanks in a good many cases, with the resulting pollution of the subsoil, a very undesirable condition." Furthermore, "it seems that it would be cheaper to put it in an ordinary system of sanitary sewers, with the necessary flush tanks, etc., and at the outlet provide works to care for the sewage, according to the system best suited to the locality." LEONARD P. KINNICUTT.

A Dozen Years' Experience in Sewage Purification at Santa Rosa, California. BY J. W. KEEGAN. *Eng. News*, **48**, 1902, pp. 254–256.—Santa Rosa has a population of about 7500. A public water supply was introduced in 1873, and the first sewers were put into use in 1891, the sewage outfall being into Santa Rosa creek. Lawsuits compelled the city to buy about 18 acres of land and attempt purification by irrigation. This was not successful. Then chemical treatment was tried, but was too costly. Filtration beds were then made and worked well until February, 1902, when high water wrecked the plant. The present plant consists of a septic tank, a settling tank, eight upward filtration beds (8 feet wide, 60 feet long and 6 feet deep, filled with cobble stones with a top layer composed of old brick and furnace clinker), and four sand filters each of $^1/_4$ acre superficial area. The settling tank removes a large amount of suspended matter from the effluent of the septic tank, and thus keeps the filter from becoming clogged. The upward filters are used in rotation, each one working for two days in succession and resting fourteen.

LEONARD P. KINNICUTT.

Water Pollution Prevention and Sewage Purification in the Mersey and Irwell District, England. BY R. A. TATTON. *Eng. News*, **48**, 1902, p. 261.—This is a review of the Annual Report, 1901–1902, of R. A. Tatton, Chief Engineer of the Mersey and Irwell Joint Commission. The population of the district aggregates 2,456,723, located in 94 municipalities, seven of which had a combined population of 1,304,314. Of the 94 municipalities 86 had works for the treatment of sewage, in operation, in March, 1902; three had works under construction, two had plans under consideration, leaving only three that have thus far taken no action. Pollution by solid matter has been largely prevented, but serious pollution is caused by soluble putrescible organic mat-

ter. As regards the treatment of sewage, Mr. Tatton states: "Half measures for the purification of sewage are of little or no use—in fact, a partially treated sewage, which has been held up for some hours in tanks, and in which decomposition has advanced to some considerable extent, will cause more nuisance in the upper reaches of the stream into which it is discharged, even than raw sewage in which the advanced stages of decomposition will not be reached until it has been diluted and brought in contact with the larger volume of the main rivers," and as to biological filters he says: "This method of treatment is being adopted more and more every day, and although it may never take the place of first-rate land treatment as far as efficiency is concerned, it is of great value where suitable land cannot be obtained, or where for other reasons it is undesirable to have a large expanse of land under sewage treatment." Liquid trade wastes are one of the most serious troubles with which the committee has to contend. On the river Mersey alone there are 445 manufactories for which separate purification works are necessary, beside 250 which drain into the public sewers. Of these 445 manufacturing plants, 294 now have efficient, and 139 have inefficient, purification works; 5 have works under consideration, and 7 have adopted no treatment whatever. Of the manufacturing establishments, 250 are bleach, print and dye works; 58 are woollen works; 27 are engaged in making of paper, and 14 in the production of chemicals. Figures are given in detail regarding the various manufacturing establishments.

LEONARD P. KINNICUTT.

The Sanitary Analysis of Some Deep Well Waters. BY J. B. WEEMS. *Proc. Iowa Academy of Science*, 1902, pp. 63–70. —The paper gives the analyses of the waters of 23 deep wells, ranging in depth from 381 feet to 2224 feet. In commenting on these analyses, the author states the amount of free ammonia at once attracts attention, 17 of the samples containing over 0.008 parts in 100,000, and 9 containing 0.1 part. The albuminoid ammonia, except in the case of one well, which is to be further studied, is not especially high. Nitrogen as nitrates is very low, and in only two cases is there any nitrogen as nitrites, but in these two cases it is excessive 0.016 and 0.025. The oxygen absorbed, determined by the English five minutes and four hours permanganate of potassium method, gives less than 0.25 part in 100,000, except in two cases, one of these giving 0.9, the other 2.69 parts of oxygen consumed in four hours in 100,000. The chlorine and total solids are much higher than in surface waters, but not as high as in many mineral waters. The author also gives the various standards that have been proposed to classify surface and ground waters, and shows that the application of any

of these standards to the sanitary analysis of deep well waters is unsatisfactory and misleading. The excessive amount of free ammonia is accounted for by reduction of nitrates and nitrites by sulphide of iron or organic matter.

LEONARD P. KINNICUTT.

Sanitary analyses of Massachusetts deep well waters have been made by T. M. Drown (Report of the Massachusetts State Board of Health, 1894, p. 421), and by W. T. Sedgwick (*Ibid.*, p. 435). Many of these waters contain excessive amounts of nitrogen as nitrites. LEONARD P. KINNICUTT.

INDUSTRIAL CHEMISTRY.

Lead vs. Nickel Storage Batteries. BY HUGH RODMAN. *Electrical World and Engineer*, September 27, 1902.—From the requirements of practice, Mr. Rodman considers that the list of available anodes and electrolytes is limited to lead in sulphuric acid and nickel in an alkali hydroxide. This does not mean, however, that the active material must necessarily contain nickel or lead but simply that the grid must be one or the other of these metals in its appropriate solution. He considers the Edison nickel-iron cell as the most promising member of new types of storage batteries and compares it with the lead cell with respect to grid, active material and electrolyte. The alkali battery possesses a great advantage in making its support plates of a stiff easily worked metal. This stiffness ensures absence of buckling and allows of a high degree of mechanical perfection in the working. Concerning the electrolyte, he says that while the possibility of using a small amount of electrolyte is one of the important factors in making the alkali battery light and small this advantage adds to the trouble of refilling.

The voltage of the alkali cell is only about one-half that of the lead cell, therefore for the same energy output, we must double either the current or the number of cells and so multiply useless dissociation by two. There are other disadvantages. While acid does not creep, alkali both creeps and turns to carbonate.

He believes that for central station work, the position of the lead cell seems secure because of its low first cost, low internal resistance, high voltage and efficiency. For lighter service, particularly for electric wagons where Watt efficiency and cost are to some extent subordinate to convenience, the choice will depend largely on capacity and reliability. S. P. SADTLER.

Chemical Industries at Sault Ste. Marie. *Eng. and Mining Journal*, October 18, 1902.—The Consolidated Lake Superior Co., which is developing the water power of the St. Mary's river on a

very large scale, is also developing with great rapidity a group of most important chemical industries. First a wood pulp grinding mill was erected to utilize the abundant spruce forests of the vicinity. Then a sulphite pulp mill was planned that required sulphurous acid, so a nickel and copper mine was bought. Utilization of the residuum of the ore was the natural sequence; the cupriferous residue was smelted into matte and for the non-cupriferous a process of smelting with ferro-nickel was developed. Pig iron was then needed, so an iron mine was required. This involved the manufacture of charcoal, which was entered upon in the most modern way, so as to recover the by-products—wood alcohol, acetate of lime, etc. A steel plant and a rail mill followed. Saw mills and a railroad to bring the ore and lumber were also necessary adjuncts. A large number of subsidiary companies have been formed to develop these industries but all in affiliation with the company which is developing the power.

S. P. SADTLER.

Brazing Cast-Iron by a New Process. BY FRIEDERICH PICH. *Eng. News*, Oct. 16, 1902.—A process of brazing cast-iron whereby perfect adherence of the iron to the brazing spelter is effected, is now in successful operation by the American Brazing Co., of New York, under the patent of Friederich Pich. After the iron surfaces have been cleansed from oil, dirt and rust, and made perfectly bright, a purplish brown decarbonizing powder consisting of cuprous oxide and borax, and known as "ferrofix," is mixed with a liquid to a creamy consistency and applied with a brush to the surfaces to be united. The two pieces of cast-iron to be brazed are then wired together, lined up and supported ready for the blast from the "torches." The iron is then brought to a medium cherry-red when some of the ferrofix in powder is added and thus continued until the iron is a very light cherry-red when it is ready for the spelter. When this latter has been run into the crack and the joint is completely covered, the casting is allowed to cool slowly in the air. The broken edges of the casting, it will be seen, are freed from the graphitic carbon by the ferrofix treatment to a depth of from $^1/_{16}$ to $^1/_8$ of an inch from the surface, and are then capable of perfect brazing.

S. P. SADTLER.

Manufacture of Nitric Acid by the Atmospheric Products Co., at Niagara Falls. BY J. W. RICHARDS. *Electrochemical Industry*, Sept., 1902, p. 20.—The patents of Bradley and Lovejoy are now being developed by this company on a practical scale at Niagara Falls. The patent is for a manner of producing nitrogen compounds from atmospheric nitrogen, and points out that whereas the silent electric discharge and the spark or disruptive dis-

charge can cause nitrogen and oxygen gases to combine, they have very little capacity in this respect, which is also the case with the electric arc as ordinarily used. To obtain efficiency, it is necessary to use an arc, divided up into such small, thin, flat subdivisions as to present a large surface for a small amount of energy; the thinner the arc the greater is its efficiency up to the point where it breaks. It is necessary, therefore, to greatly subdivide the current, to arrange the arc circuits in parallel, and to provide against short-circuiting. The company uses a 45 Kilowatt generator, ordinarily delivering 0.75 ampere direct current at a potential of 8,000 volts, but capable of delivering several amperes at as much as 15,000 volts. The current supplies 138 arc contacts, each of which is made and broken 50 times per second, giving to each arc some 0.005 ampere. The arcs are all sprung successively 6,900 per second in the apparatus, each arc lasting about 1/20,000 of a second, and thus giving practically a steady load to the machine. As each arc tends the moment it is formed to increase suddenly in volume, the short-circuiting, which this would produce, is retarded by placing inductance coils or resistances in series with the arcs. These are so calculated that during about 1/40,000 of a second they impede the flow of the current, therefore preventing too high an amperage flowing, and during the succeeding 1/40,000 second, while the arc is being drawn out and is about to break, it sends an impulse which increases the flow and so prolongs the arc. Using 8,000 volts, with an average current of 1/200 of an ampere to an arc, the arcs are drawn out 4 to 6 inches. By keeping a constant flow of air into the apparatus, the per cent. of the combined products in the issuing air is only 2 to 3 per cent. and much loss by dissociation is thus avoided by keeping down the concentration of nitric oxides. The patent claims are for "exposure of a mixture of nitrogen and oxygen to the action of an electric arc and renewing the mixture so as to prevent dissociation." The output is represented by one pound of theoretical HNO_3 per 7 horse-power per hour of electric current used.

The air used is first carefully dried to avoid formation of acid in the apparatus and consequent corrosion of the metallic parts. The inside of the apparatus is protected by a coating of asphalt varnish and glass peep holes provided, permitting inspection of the interior. A mixture of equal parts of oxygen and nitrogen works better than air, giving a higher return for the current used. The issuing gases pass into an iron reservoir two feet in diameter by ten feet high, where they have a chance to still farther combine, and thence pass into a scrubbing tower to condense the gases produced. In commercial practice, water towers will be used to obtain nitric acid, while Lunge's

scrubber, supplied with milk of lime, will be used to produce calcium nitrate for fertilizing purposes. S. P. SADTLER.

Electrochemistry at the World's Fair, St. Louis. BY W. E. GOLDSBOROUGH. *Trans. Am. Elec. Chem. Soc.*, Vol. II, 1902.—The writer is chief of the electrical department of the exhibition. One of the five electrical groups is devoted to electrochemistry. Class 434 includes batteries; class 435, electrolytic appliances and processes; class 436, electrothermic appliances and methods; class 437, applications to industrial chemistry, disinfection, bleaching, etc. Efforts will be made to have as many processes as possible in actual operation, and considerable power has been set aside for this purpose. J. W. RICHARDS.

The Electrochemical Industries of Niagara Falls. BY J. W. RICHARDS. *Elec. Chem. Ind.*, September and October, 1902.—A long article (18 pages, 33 illustrations) describing the natural facilities of location, power-plants and the eighteen industries located at this great power center. Of the 60,000 horse-power now being developed there, 45,000 is being used in electrochemical processes. The cost of the power is $15 to $20 per horse-power year, according to quantity, which is cheaper than it could be generated from coal even if the coal cost nothing. *The Castner Electrolytic Alkali Co.* employs 6,000 horse-power, using 1,600 of the Castner rocking cells to electrolyze brine. They use 50 tons of salt daily, and produce 36 tons of caustic alkali and 90 tons of bleaching-powder. Their efficiency is 93 per cent. on the amperes used. *The Roberts Chemical Co.* uses 500 horse power in the production of caustic potash and hydrochloric acid from potassium chloride, but their efficiency is low and general details of the operation are lacking. *The Acker Process Co.* uses 3,000 horse-power, in forty pots, to electrolyze molten sodium chloride, the evolved chlorine being used for bleaching-powder, the sodium being absorbed by melted lead, and the alloy decomposed by steam, to form melted caustic soda. The 8,000 ampere current yields 90 to 95 per cent. of the theoretical output. The current density is 2,750 amperes per square foot of anode surface. The anodes are Acheson graphite. The plant produces 23,000 pounds of caustic soda and 57,000 pounds of bleaching-powder daily. *The National Electrolytic Co.* uses 2,000 horse-power to electrolyze potassium chloride solution at 70° C., producing potassium chlorate. The efficiency is about 70 per cent. on the amperes used. The anodes are platinum foil, the cathodes bare copper rods, close to the cathodes. The apparatus looks like a filter-press. In it, about one-third of the energy of the current is absorbed in the chemical work, and two-thirds converted into heat. Their output is about five tons of chlorate per

day. *The Oldbury Chemical Co.* uses 1,000 horse-power to manufacture potassium chlorate and yellow phosphorus. The latter is made from natural phosphate rock by the Readman-Parker furnace, the mixture of rock, silica, and coke being fused to calcium silicate, while the phosphorus distils. The output is given at 1,000 pounds of phosphorus and an equal amount of chlorate daily. *The United Barium Co.* uses 1,200 horse-power to melt, in three furnaces, a mixture of barium sulphate and carbon, producing barium oxide, which is run out, dissolved in hot water, and crystallized from solution by cooling. The output is now twelve tons of crystals daily, and the plant is being enlarged to sixty tons. The reaction in the furnace is practically $BaSO_4 + C = BaO + SO_2 + CO$. Attempts are being made to utilize the sulphur dioxide for making sulphuric acid. *The Ampere Electrochemical Co.* is experimenting on the manufacture of cyanides by heating BaO with carbon in an electric furnace, thus producing BaC_2, heating this in a current of producer gas, and thus forming BaC_2N_2. This is treated with dilute acetic acid, producing barium acetate, and the HCN gas evolved is run into caustic soda solution to produce sodium cyanide. The solution of barium acetate is evaporated to dryness and distilled, giving off pure acetone and leaving barium carbonate. A number of other promising processes are being experimented with by this company. Their manufacture of artificial camphor is already an assured success. *The Atmospheric Products Co.* has an experimental machine in working order manufacturing nitric acid by the use of nitrogen and oxygen gases, led into a chamber where 6,900 arcs per second cause the combination. Each arc takes 0.005 ampere, at 10,000 volts potential, the arc being kept down to this small amperage by a choke coil in series with it. The output is one pound of pure HNO_3 per 7 horse-power hours of current, which costs about one cent at Niagara. The company is contemplating a 2,000 horse-power plant. *The Electrical Lead Reduction Co.* reduces lead sulphide to spongy lead by Salom's process, wherein the galena is used as cathode in electrolyzing dilute sulphuric acid. A summary of this process has already been given in this Review **24**, 526. The full capacity of the plant will be ten tons of sponge daily. The spongy lead is in a condition very suitable for solution, corrosion, or conversion into other lead salts, and can be pressed directly into a storage-battery plate. *The Niagara Electrochemical Co.* uses 1,000 horse-power in electrolyzing fused caustic soda, by Castner's process, within 20° C. of its melting-point. The output is about three tons of sodium daily. Each pot takes 1,200 amperes at 5 volts, drop of potential, and the efficiency on the amperes is about 90 per cent. or four horse-power hours per pound of sodium. The larger part of the sodium is used for producing sodium peroxide, which com-

mands 35 cents per pound. The market for pure sodium is very limited. *The Norton Emery Wheel Co.* uses 500 horse-power to melt bauxite in an electric furnace (Jacobs' process) and produces therefrom an artificial abrasive. Carbon terminals dip into the fused bauxite, and fresh material is added from time to time until the furnace is full. Then the carbons are removed, the contents allowed to solidify, and the block removed from the furnace. *The Pittsburgh Reduction Co.* uses 10,500 horse-power for producing aluminum by the Hall process, producing some 19,000 pounds of metal daily. The pots receive 10,000 amperes at 5 volts, and yield 80 to 90 per cent. of the theoretical output. The pure alumina used is obtained by a chemical process, but an electrical process is contemplated, *viz.*, fusion of bauxite in an electric furnace with sufficient reducing material to reduce all its impurities. A current of 1300 horse-power, at 33,500 amperes, is to be used to run these furnaces. The alloy produced will have uses in iron and steel or as a paint. *The Carborundum Co.* uses 2,000 horse-power (soon to be enlarged to 3,000). A current of 2,000 up to 8,000 amperes is passed through a carbon core in a furnace, around which is the mixture of carbon, silica and salt to be reduced. In a thirty-six-hour run, three to four tons of carborundum, CSi, is produced. The company makes this up into all sorts of abrasive tools, selling nearly 1,200 tons of this product yearly. *The International Acheson Graphite Co.* uses 2,000 horse-power in graphitizing carbon articles or converting anthracite coal into graphite. The articles to be graphitized are stacked crosswise in a furnace, covered with carbon, and 3,000 to 9,000 amperes run through for twenty-four hours. The coal is placed in small lumps in a long trough, lined with carborundum blocks, and treated similarly. The furnaces are 30 feet long, and require 200 volts to start them and run down to 80 volts at the close of a run. The yearly production is 500 tons of graphite.

J. W. RICHARDS.

A Unit of Electrical Quantity for Use in Electrochemical Calculations. BY A. E. COWLES. *Trans. Am. Elec. Chem. Soc.*, Vol. II, 1902.—It is found that a kilo-ampere operating one day sets free almost exactly two pounds of hydrogen, or two pound-equivalents of any chemical element or 500 amperes in a day liberate one pound-equivalent. The agreement is close enough for industrial use Another close agreement is, that 100 amperes in a day, liberating one-fifth pound, give almost exactly one cubic meter of hydrogen or of any other equivalent gas. The writer indulges in some speculations as to a possible reason for this coincidence. He proposes the name "pound col." for the 500 ampere-day.

J. W. RICHARDS.

The Theory and Practice of Continuous-Flow Electric Calorimetry. BY H. T. BARNES. *Trans. Am. Elec. Chem. Soc.*, Vol. II, 1902.—The method is applicable to measuring with considerable exactness the specific heats of liquids, and will be able to render considerable service to thermochemical measurements. It is, therefore, commended to the attention of experimental thermo-chemists. J. W. RICHARDS.

On the Fusion of Quartz in the Electric Furnace. BY R. S. HUTTON. *Trans. Am. Elec. Chem. Soc.*, Vol. II, 1902.—The author carried on experiments at first with a small open arc and magnetically deflected flame. With this, the quartz must be kept outside the reducing effects of the arc, to obtain a clear fusion; if the quartz was too close, a black spot formed on it immediately. For working on a large scale, a direct current of 300 to 500 amperes at 50 volts potential was passed through a carbon rod embedded in silica sand. In this way, a tube of fused quartz appears almost at once around the rod, which is then fused down to a clear tube in an oxyhydrogen flame. The fused quartz has the smallest coefficient of expansion of any known substance, is almost unbreakable by heat or cold, and will probably become a commercial article. J. W. RICHARDS.

Advances in the Closed, Continuous Electric Furnace. BY E. R. TAYLOR. *Trans. Am. Elec. Chem. Soc.*, Vol. II., 1902.—Describes with illustrations, an electric furnace 16 feet in diameter by 41 feet high, used for making carbon bisulphide. For electrodes, carbon troughs project into the furnace, into which is fed broken charcoal. The trough conducts the current with little resistance, but inside the furnace communicates its current to the lumps of charcoal, which are being continually consumed by their high temperature in contact with sulphur vapor. Thus the continuity of the electrodes is maintained. There are four electrodes, one every 90°, and the current can be sent through adjacent pairs or opposite pairs, so as to melt down the charge uniformly. The writer says he would have no hesitation in building such a furnace so large as to "dwarf the largest blast-furnaces." J. W. RICHARDS.

The Efficiency of Electric Furnaces. BY J. W. RICHARDS. *Trans. Am. Elec. Chem. Soc.*, Vol. II, 1902.—Calculations are made of the proportion of the heat energy of the current used which is efficiently applied to heating up the furnace contents to the reaction temperature and in supplying the deficit of heat called for by the chemical reactions taking place at that temperature. The ratio of the sum of these to the total heat energy of the current used is called the *efficiency*. As an example of heat-

ing alone without fusion or chemical reaction, the Acheson graphitizing furnaces are considered, the efficiency here being 75 per cent. As an example of simple heating with fusion, the Jacobs' process of fusing alumina to make artificial corundum is taken, the efficiency calculated being 74 per cent. As an example of heating with chemical change, but without fusion, the 1000 horse-power carborundum furnaces are taken, which calculate up 76.5 per cent. efficiency. As an example of heating to fusion, with chemical reaction, the production of calcium carbide shows a calculated efficiency of 62 per cent. The electrolytic decomposition of a fused salt was illustrated by calculations on one of the Acker process pots, where 8000 amperes pass through melted sodium chloride, the efficiency being 63 per cent. Of the total heat generated by the resistance of the electrolyte, one-fifth is utilized for melting the fresh salt added and four-fifths is radiated. J. W. RICHARDS.

Voltaic Cells with Fused Electrolytes. BY E. A. BYRNES. *Trans. Am. Elec. Chem. Soc.*, Vol. II., 1902.—An account of numerous voltaic couples used in fused salts, such as various metals with graphite, in melted caustic soda. The voltages observed were up to 2.3 volts. Compound cells were built up of nitre in a porous cup, with caustic soda outside. The results of 33 measurements of electromotive forces are given. In the discussion, some took the position that such cells were largely electrothermic in their action, *i. e.*, more electrothermic than electrochemical as regards their electromotive force.

J. W. RICHARDS.

Fuel Oil. BY W. W. REED WEST. *Electrician*, **30**, 302–3.—This gives a description of the experience of the Houston Lighting and Power Co. The oil is kept in brick underground storage tanks where it is heated in cold weather; hence it is pumped to small receivers whence it is forced to the burners. It is found that 1 ton of soft coal is equivalent to $2^1/_4$ to 4 barrels (320 pounds each) of oil: on four different burners, tests at the switchboard showed 0.575 to 0.713 gallon oil per kilowatt-hour. On two Babcock and Wilcox boilers, tests showed 13.48 pounds, and 14.7 pounds of water, from and at 212° per pound, of oil as against 7.43 pounds per pound of coal. Where oil has been properly used no evidence of injury to the boiler has been found.

A. H. GILL.

AGRICULTURAL CHEMISTRY.

Silage Studies. BY F. W. MORSE. *N. H. Agr. Expt. Sta. Bull. No. 92*, pp. 49–62.—Analyses of Sanford corn at different stages

of growth showed that while the greatest yield of fodder was obtained by cutting the corn when in full bloom, the greatest yield of food constituents was secured by cutting when the ears were at the roasting stage. Thickness of seeding had but little effect upon the composition of the fodder. Tests of the feeding value of silage prepared from Sanford, Leaming, and Mosby Prolific corn, carried out with several groups of cows during two winters, indicated that as regards milk production the three kinds of silage rank in value in the order mentioned. Analyses showed a decrease in the quantity of food constituents in the same order. Analyses of green fodder and of the silage made from it showed that changes in composition were confined almost exclusively to the sugars, which were practically destroyed.

H. W. LAWSON.

Chemical Changes in Apples During Storage. BY F. W. MORSE. *N. H. Agr. Expt. Sta. Bull. No. 93*, pp. 82–87.—Apples were kept in a cool cellar one season and in cold storage two seasons, and determinations were made at frequent intervals of total and invert sugar and of acid in the sound fruit. The author summarizes the results as showing that chemical changes independent of decay take place within the apple and that these changes are retarded by low temperatures and hastened by high temperatures. Other parts of the bulletin deal with cold storage of apples from different standpoints. H. W. LAWSON.

Methods for the Estimation of the Proteolytic Compounds Contained in Cheese and Milk. BY L. L. VAN SLYKE AND E. B. HART. *N. Y. State Agr. Expt. Sta. Bull. No. 215*, pp. 81–102.—This bulletin gives in detail methods for the separation and estimation of the nitrogen compounds of cheese and milk and for the determination of chloroform used as an antiseptic in these products. These methods were employed in an extended study of the enzymes in cheese reported by L. L. Van Slyke, H. A. Harding, and E. B. Hart in Bulletin 203 of this station.

H. W. LAWSON.

The Feeding Value of Beet Pulp. BY B. C. BUFFUM AND C. J. GRIFFITH. *Colo. Agr. Expt. Sta. Bull. No. 73*, pp. 3–10.—Information, mainly compiled, is given on the composition of sugar-beet pulp and its feeding value. Part II of the bulletin reports a feeding experiment with cows to test the value of pulp and sugar-beets. H. W. LAWSON.

The Chemical Composition of Insecticides and Fungicides. BY J. K. HAYWOOD. *U. S. Dept. Agr., Bureau of Chem. Bull. No. 68*, pp. 62.—Of about 300 samples of insecticides and fungicides collected by the Division of Entomology, 156 samples, con-

sidered as representing fairly the present state of the market in the United States, were selected for analysis. These included forty-five samples of Paris green, eleven of London purple, ten of soap, nine of hellebore, ten of pyrethrum, fourteen of mixtures containing borax, five of roach pastes, four of tobacco extracts, and one each of forty-six other preparations. The results of analysis are given together with the methods used, and show according to the author that "there are many insecticides on the market which are nearly worthless, and many for which a very exorbitant price is paid that could just as easily be prepared at home." H. W. LAWSON.

Alkali. BY J. D. TINSLEY. *N. Mex. Agr. Expt. Sta. Bull. No. 42*, pp. 31.—A popular presentation of information on alkali, its composition, origin, accumulation, and removal, with special reference to conditions existing in the Pecos Valley.
H. W. LAWSON.

Drainage and Flooding for the Removal of Alkali. BY J. D. TINSLEY. *N. Mex. Agr. Expt. Sta. Bull. No. 43*, pp. 29.—A practical test was made of underdraining and flooding for the improvement of alkali lands. A minimum accumulation of alkali was found in the soil under investigation when the water table was at a depth of 6 inches or less, and a maximum accumulation when the water table was at a depth of about 2 feet. About one-seventh of the total alkali in the first 2 feet of soil was removed by ten floodings and a large amount was carried down from the first foot into the second. H. W. LAWSON.

Clover as a Fertilizer. BY W. SAUNDERS AND F. T. SHUTT. *Canada Cent. Expt. Farm Bull. No. 40*, pp. 23.—A general discussion on the value of clover for green manuring, including the results of numerous experiments. H. W. LAWSON.

Fertilizers. *Ky. Agr. Expt. Sta. Bull. No.* 102; *Md. Agr. College Quart. Nos.* 16, 17; *Mass. Agr. Expt. Sta. Bulls. Nos.* 83 and 84; *Me. Agr. Expt. Sta. Bull. No.* 85; *Mich. Agr. Expt. Sta. Bull. No.* 202, *Rep.*, 1901, pp. 91–131; *Bull. N. C. State Bd. Agr.*, 23, *No.* 6; *N. J. Agr. Expt. Sta. Rep.*, 1901, pp. 17–77; *N. Y. State Agr. Expt. Sta. Bull. No.* 216; *Pa. Dept. Agr. Bull. No.* 101; *R. I. Agr. Expt. Sta. Bull. No.* 85; *S. C. Agr. Expt. Sta. Bull. No.* 70; *Vt. Agr. Expt. Sta. Bull. No.* 93.

Feeding Stuffs. *Mass. Agr. Expt. Sta. Rep.*, 1901, pp. 148–193; *N. J. Agr. Expt. Sta. Bull. No.* 160, *Rep.* 1901, pp. 78–136; *Vt. Agr. Expt. Sta. Bull. No.* 97.

Compilation of Analyses of Fruits, Garden Crops, and Insecticides. BY H. D. HASKINS. *Mass. Agr. Expt. Sta Rep.*, 1901, pp. 132–147.

PATENTS.

JUNE 3, 1902.

701,802. James A. Denton and James H. Freas, Johnson City, Tenn. Assignor to Elliott C. Kirkpatrick, same place. **Smokeless powder.** Potassium chlorate, 16, and linseed oil, 8, are mixed and ground, then wheat flour, 2, chrome yellow, 1, and water enough to make a stiff dough are added, and the mass dried and ground or granulated.

701,804. Thomas A. Edison. **Reversible galvanic battery.** Hollow nickel plates, hydrated lower oxides of nickel or cobalt and graphite, potassium hydroxide for one element and electrolyte. For the other element ferrous sulphide converted to ferrous oxide, or cadmium, also mixed with graphite.

JUNE 10, 1902.

701,995. John A. Burgess, Bradford, Canada. **Purifying acetylene gas.** Passes the condensed gas over charcoal treated with a solution of metallic salt as ferric sulphate, then through calcium carbide and through a chamber filled with lava pieces, and repeats the last two steps.

702,009. Frederick G. Jordan, Spokane, Wash. **Making cement.** Burns lime and while incandescent mixes in a silicious clay, puts mixture in an air-tight chamber, adds sodium silicate and steam, stirs, molds, burns and grinds.

702,047. Caleb G. Collins, Woodmere, N. Y. Assignor to Calvin Amory Stevens, New York, N. Y. **Rendering metallic sulphides soluble.** Crushes the material, drenches it with ammonia and drains off the excess, exposes to air or oxygen, leaches the ore, and repeats till all the metal is extracted.

702,050. Asahel K. Eaton, Brooklyn, N. Y. **Removing scale from iron.** Immerses in a bath containing stannous sulphate and sodium bisulphate.

702,126. Phillippe Chuit and Fritz Bachofen, Geneva, Switzerland. Assignors to Chuit Naef & Co., same place. Making **alpha ionone.** Reacts with syrupy phosphoric acid on pseudoionone at a low temperature, adds sodium sulphite and sodium and ammonium chlorides which precipitate sodium sulphonate of alpha-ionone, which is decomposed by caustic soda and distilled by steam.

702,140. Geoffrey LeRoi de Lencheres, Vierzon, France. **Artificial stone.** Clay, 65; silica, 4; manganese dioxide, 6; lime and barium sulphates, 2-3 per cent., a hydrocarbon and gravel to a suitable consistency.

702,153. Jarig P. Van der Ploeg, The Hague, Netherlands. Obtaining **Antimony.** Pulverizes the ore, mixes with an alka-

line sulphide and water to dissolve out double sulphides for use as the best form of electrolytes, electrolyzing the solution and using the liquor over again for dissolving fresh material.

702,162. Alexander Straus, New York, N. Y. Making a **sponge substitute.** Mixes sulphurized rubber with paraffin and water, heats it whereby cells are formed by the steam, and the rubber is vulcanized.

702,171. Augustus Bischler, Basle, Switzerland. Assignor to Basle Chemical Works, same place. Making **phthalic** and **benzoic acids.** Heats above 200° C. a mixture of naphthalene derivatives as naphthol with a metallic oxide as copper oxide, and an alkali.

702,172-3-4-5-6-7-8. All to William N. Blakeman, New York, N. Y. **Paints.** Mixes cotton-seed oil and zinc oxide equal parts, and a drier. May add manganese oxide, paraffin wax, or lead acetate before drying and grinding.

702,244. Andrew J. Polmeteer, Whitehall, Mont. Assignor to Joseph Mitch and Alberta G. Dygart, Butte, Mont. **Precipitant for copper water.** A solution of calcium sulphide with an excess of calcium hydroxide.

702,258. Clarence W. Taylor, Sioux City, Iowa. **Bunsen burner.** The burner tube is made with corrugations forming gas passages, with a plate to regulate the supply of both air and gas.

702,305. Edward D. Kendall; Brooklyn, N. Y. **Extracting precious metals.** Leaches them with a solution of a cyanide and a percarbonate of alkali.

702,357. Hans Von Dahmen, Vienna, Austria-Hungary. **Detonating composition.** Copper-ammonium nitrate 30 to 40, potassium nitrate the same, sulphur 10 to 7, and aluminum 18 to 28 parts.

702,369. Carl Levinstein and Carl Mensching, Manchester, England. Assignors to Levinstein limited, same place. **Black sulphur dye.** Heats diluted nitrophenols with oxyazo benzene, an alkaline sulphide and sulphur. The dye is soluble in concentrated sulphuric acid and is precipitated therefrom by water.

JUNE 17, 1902.

702,445. Martin Lange and Tadensz Emilewicz, Amsterdam, Netherlands. **Mordant colors.** 1,8-dihydroxynaphthalene is condensed with a substance containing the carboxylic radical, whereby said radical is bound to the nucleus of the 1,8,dihydroxynaphthalene, forming a yellow dye.

702,554. Louise C. Henriot, Rheims, France. **Photographic plate.** The plates are first coated with albumin and potassium silicate, then mercuric nitrate and potassium bromide are dis-

solved in gelatin, and nitric acid added until a milky white substance is formed, with which the plate is coated, the reaction producing mercuric bromide and potassium bichromate.

702,566. Edmund Knecht, Manchester, England. **Reserve and discharge on textile fabrics.** Treats dyed goods with a titanous salt in a suitable medium adapted to dissolve it.

702,571. Jerome Loiselet, Assignor to Société des Produits Amylaces, Paris, France. Subjects **starchy** material to an acid solution, washes and grinds it, purifies by washing on an inclined plane, dilutes and electrolyzes, removes the organic precipitate from the mass, purifies again on inclined planes, dilutes and dries.

702,582. James W. Neill and Joachim H. Burfeind, Salt Lake City, Utah. **Recovering metals from ores.** Agitates a charge of copper pulp by forcing through it sulphurous acid gas, filters off the pulp, adds a suitable reagent to the filtrate to precipitate the copper, which also liberates sulphurous acid gas that is mixed with gas from the roasters to agitate more pulp.

702,611. Oskar H. Anderson, Stockholm, Sweden. Assignor to Silicate Brick Syndicate, Montreal, Canada. **Artificial stone.** Mixes sand 95 with a mixture of red hot sand and slaked lime five parts, moistens with dilute hydrochloric acid, molds into bricks, put these in a chamber also containing, separate from the bricks, lime to be slaked, and admitting steam at 100 pounds pressure whereby the bricks are dried and the lime slaked.

702,678. William Frampolini, San Luis Potosi, Mexico. **Composition for rubber.** Mixes the gum of Synantheras Mexicanas with sulphur, and treats the mixture with heat and pressure.

702,693. Rudolph F. Bartle, Falls Church, Va., and Albert B. Hoen, Baltimore, Md. **Designs on metal surfaces.** Mixes a mordant with gelatin, forms a design therewith on a flexible sheet, presses it on a metallic surface, heats the plate and finally applies a bath of a liquid carbon compound as benzene.

702,713-4. Henry B. Febiger, Philadelphia, Pa. **Apparatus and process of extinguishing fires.** Supplies to a closed compartment a liquefied gas not a supporter of combustion, as sulphur dioxide, vaporizes the gas, and withdraws it, mixes it with fresh gas and returns it, thereby cooling the compartment.

702,730. Benno Homolka, Frankfort on-Main, Germany. Assignor to Meister Lucius und Brüning, Hochst-on-Main, Germany. **Purifying indigo.** Extracts the raw indigo with pyridine bases.

702,764. Jules L. Babe, and Alexis Tricart, Paris, France. **Extracting zinc.** Makes briquettes of poor zinc ore, sodium carbonate and carbon, heats them till the zinc is volatilized and

driven off, condensing the vapors containing zinc oxide, mixing this product with sodium carbonate and carbon, again volatilizing the zinc and collecting it.

702,855. Frank R. Felt, Chicago, Ill. Assignor to Merritt Greene, Marshalltown, Iowa. **Retort for obtaining oxygen** from air and steam. The combination with the outer wall of partitions forming oxidizing and deoxidizing chambers, a series of compartments in each chamber opening alternately into the top and bottom of each chamber, the last oxidizing chamber open at the top, a supply chamber opening near the bottom into the first deoxidizing compartment, an opening near the bottom of the last deoxidizing compartment into the first oxidizing compartment, a series of air pipes in the oxidizing chamber and steam pipes in the deoxidizing chamber, said pipes terminating in an upward direction in the lower parts of the compartments that open near the top into the next succeeding compartment and the oxidizing and deoxidizing chambers being provided respectively with means for the escape of the nitrogen and withdrawal of oxygen.

702,864. Washington, L. Albee, Buffalo, N. Y. Assignor one-half to Schoellkopf Co., same place. **Preparing skins for tanning.** Mixes sodium sulphide, sodium bicarbonate and borax in solution for steeping the skins, then agitates them in a similar mixture with caustic soda in place of borax, then agitates them in sodium bicarbonates and borax alone.

702,877. Theodor Meyer, Buergel, Germany. Assignor to K. Oehler, Anilin Farben Fabrik, Offenbach on-Main, Germany. Making **hydrogen chloride** and **sodium sulphate.** Pulverizes and mixes in equimolecular proportions salt and sodium bisulphate and heats in a closed vessel to a temperature of 400° C.

JUNE 24, 1902.

702,943. Gustave Guiraud, Cripple Creek, Colo. Assignor to Robert McKnight, Philadelphia, Pa. Treating **silicate ores.** Roasts and stirs in free air a charge of ore, an oxygen compound of silicon, and a haloid salt of an alkali or alkaline earth metal, the quantities being proportioned to form a stable silicate and a haloid of a precious metal which is volatilized and collected.

702,996. Wladyslaw Pruszkowski, Schnodnica, Austria. **Alloy.** One atomic weight of aluminum with two atomic weights of any metals of the iron group as nickel and iron, and adding a metal of the chromium group as chromium. Claims an alloy containing $Fe_2AlNi_{20}Al_{10}$.

703,058. Seward F. Gray, Titusville, Fla. **A tanning agent.** Separates the red and white parts of the roots of the saw palmetto, squeezes the juice out separately, allows a precipitate to settle from the clear portion which is racked off and concentrated *in vacuo*. May use it for dyeing.

703,064. Louis Hicks, Englewood, N. J. **Mantle for incandescent gas light.** Made of oxide of thorium and of yttrium, the former in large amount and oxide of cerium in small amount. Lanthanum may supplant thorium.

703,096. Otto C. Strecler, Darmstadt, Germany. Preparing **lithographic plates.** A metal plate with a lithographic design or transfer is coated with a solution of salts as ammonium fluoride whose acids form insoluble compounds with the metal and an oxidizing means as ammonium nitrate with an acid which does not decompose the insoluble salts formed or set an acid free, but forms an insoluble hygroscopic layer firmly adherent to the metal.

703,104. Edgar Wedekind, Tubingen, Germany. **Chlorinated methyl ether of menthol.** Has the formula $C_{10}H_{19}OCH_2Cl$, a yellow oily liquid of peculiar pungent odor, specific gravity about 0.9821, insoluble in water and alcohol, soluble in ether and chloroform.

703,105. Arthur Weinberg, Frankfort-on-Main, Germany. Assignor to Leopold Cassella and Co., same place. **Dye.** Combines *p*-diazonitro *o*-chlorbenzene with 1,8-dihydroxynaphthalene 3,6-disulphonic acid, reducing the nitro-group and alkylating the compound. Soluble in water blue, turned to claret by alkalies and precipitated by acids in red flakes, dyeing wool fast blue shades.

703,135. Isidor Kitsee, Philadelphia, Pa. **Insulating conductor.** Coats wire with a solution of cellulose, dries and coats with a spray of sulphur, then vulcanizes.

703,151. Theodore G. Pause, Atlanta, Ga. **Artificial fabric.** Treats sheets of burlap with a solution of magnesium chloride, calcined magnesite and a mineral powder as sand, then repeats with the same to which sawdust and silica are added, then sizes the surface with soap and polishes.

703,165. Thomas Twynam, Moortown, England. **Separating tin from metals.** Mixes a solution of sodium chloride with carbon dust, dips the scrap or cuttings therein, and exposes to air, washes and recovers the tin oxide.

703,196. John A. Heany, Philadelphia, Pa. Assignor to Teater-Heany Developing Co., same place. **Insulated wire.** Coated with asbestos, sodium silicate and manganese oxide. May coat again with silicate and press on the mineral powders.

703,198–9–200–1. John A Heany. Assignor to the Teater-Heany, Developing Co., all of Philadelphia, Pa. **Insulating wire,** and composition therefor. Mixes lime with albumin for the first coating, then applies a mixture of sulphates of ammonia and soda, chlorides of same, boracic acid and water, then compresses asbestos therein, and covers that with a fire- and water-proof enamel consisting of a mixture of the two compounds previously used.

W. H. SEAMAN.

REVIEW OF AMERICAN CHEMICAL RESEARCH.

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WILLIAM A. NOYES, Editor.

REVIEWERS :

M. T. Bogert, E. M. Chamot, B. S. Cushman, Benton Dales, L. M. Dennis, A. H. Gill, H. M. Goodwin, W. F. Hillebrand, L. P. Kinnicutt, H. W. Lawson, G. N. Lewis, H. N. McCoy, A. A. Noyes, J. W. Richards, S. P. Sadtler, J. O. Schlotterbeck, W. H. Seaman, F. P. Underhill.

MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

Iowa Geological Survey. *Vol. XII. Annual Report, 1901.* 511 pp.—This volume contains statistics of mineral production and reports on the geology of Webster, Henry, Cherokee, Buena Vista, Jefferson, and Wapello counties, by different members of the geological corps. Analyses, but few of which are new, of coals, clays, gypsum, etc., are scattered through the volume.

W. F. HILLEBRAND.

The Future of the Coal and Coke Supply of British Columbia. BY W. BLAKEMORE. *Canadian Mining Rev.*, 21, 252–254. This article contains a number of analyses of lignites and bituminous coals, some suitable for steaming purposes, others for metallurgical operations requiring coke. W. F. HILLEBRAND.

Volcanic Ash in Nebraska Soils. BY E. H. BARBOUR. *Ann. Rep. Nebraska State Board of Agric., 1901.* pp. 239–242.—A brief popular statement relating to the distribution and nature of a white volcanic dust found throughout Nebraska and in adjoining states in geological deposits not earlier than the Oligocene. It is used to some extent for polishing and scouring purposes.

W. F. HILLEBRAND.

On the New Species Melanochalcite and Keweenawite with Notes on Some Other Known Species. BY GEORGE A. KÖNIG. *Am. J. Sci.*, 14, 404–416. *Melanochalcite.* From the exploration shaft of the Calumet and Arizona Copper Mining Co., near Bisbee, Arizona. The mineral seems to represent the first stage in the alteration of the cuprite nuclei of certain hard, spheroidal nodules. Next to the cuprite is a thin zone of pitchy-black material (in part lustrous and banded, in part dull and not banded) which shades gradually into the green of malachite and chrysocolla. Notwithstanding the utter lack of crystalline texture,

the author believes the black mineral to be, on the basis of three analyses of carefully selected portions varying in purity, from the same specimen, not a mixture of copper carbonate, silicate, and hydroxide, but "the basic salt of an ortho-silico-carbonic acid $H_4(Si,C)O_4$, in which Si and C may replace each other within certain limits." The formula ascribed is $Cu_2(Si,C)O_4$,-$Cu(HO)_2$. Specific gravity, 4.141 at 21°. The probable paragenesis of the minerals composing the nodules is also considered. *Keweenawite.* In the Mohawk mine, Keweenaw County, Michigan, occurs with domeykite, a reddish metallic mineral resembling massive niccolite, and showing the qualitative behavior of mohawkite. Specific gravity, 7.681 at 20°. The formula derived is $(Cu,Ni,Co)_2As$ in which the relative proportions of Cu,Ni, and Co may vary.

New analyses are given of algodonite, domeykite, and mohawkite, the latter with only 3.32 per cent. of Ni + Co as against three times as much in the original mohawkite. In addition, several substances from copper mines of Upper Michigan are described, which are either mere mixtures of copper and copper arsenides or possibly alloy-like bodies. For them the author proposes the names mohawk-whitneyite, mohawk-algodonite, and semi-whitneyite, to be used like rock names and not to designate definite mineral species. Pulveriform chalcocite is also described from the Champion and Mass mines, being made up of microscopic, hexagonal plates or groups of plates. The dust soils the fingers like pyrolusite or graphite.

W. F. HILLEBRAND.

Chemical Composition of Dumortierite. BY W. E. FORD. *Am. J. Sci.*, **14**, 426–430. Boron is found to be an unfailing constituent of dumortierite from all known localities of occurrence. The following are the author's analyses of the mineral from (1) Clip, Arizona, specific gravity close to 3.319 ; (2) San Diego, California, specific gravity between 3.226 and 3.43 ; (3) Harlem, New York, specific gravity between 3.211 and 3.302.

	I.	II.	III.
SiO_2	29.86	30.58	31.24
Al_2O_3	63.56	61.83	61.26
Fe_2O_3	0.23	0.36	0.10
B_2O_3	5.26	5.93	6.14
H_2O	1.41	2.14	2.09
	100.32	100.84	[100.83]

For reasons set forth the boric oxide and water are regarded as basic, and when the hydrogen equivalents of the R_2O_3 oxides and water are compared with the SiO_2 the following ratios appear : (1) 60 : 6.99, (2) 60 : 7.02, (3) 60 : 7.19. These correspond to an acid of the formula $H_{60}Si_7O_{44}$, " and, on the assumption that the hydrogens are wholly replaced by aluminium, the formula

becomes $Al_{20}Si_7O_{44}$ or developed as a basic orthosilicate, $(AlO)_{16}Al_4(SiO_4)_7$."

A new occurrence of dumortierite is mentioned in this paper, namely, the headwaters of the North Fork of the Washougal River in Skamania County, State of Washington, where it occurs embedded in a light-colored, fine-grained siliceous gangue in the form of small, blue spherules, about 1 mm. in diameter.

W. F. HILLEBRAND.

A New Form of Calcite-Sand Crystal. BY EDWIN H. BARBOUR AND CASSIUS H. FISHER. *Am. J. Sci.*, 14, 451–454.—The new form referred to in the title is found in the Goshen Hole Region, Wyoming. Analysis by Mr. Willis Warner shows about 63 per cent. of sand in these crystals, the balance chiefly calcium carbonate. Analyses by Messrs. Woodruff and Warner of several crystals from the earlier known Washington County, South Dakota, locality, show nearly 64 per cent. of sand to about 36 of readily soluble matter.

W. F. HILLEBRAND.

Preliminary Report on the Ketchikan Mining District, Alaska, with an Introductory Sketch of the Geology of Southeastern Alaska. BY ALFRED HULSE BROOKS. *U. S. Geol. Survey, Professional Paper No. 1.* 120 pp., 2 plates.—Contains a number of assays of gold, silver, and copper ores from various sources, in part from the laboratory of the geological survey.

W. F. HILLEBRAND.

Geology and Water Resources of the Snake River Plains of Idaho. BY ISRAEL C. RUSSEL. *U. S. Geol. Survey, Bull. 199*, 192 pp., 25 plates.—The geological importance of this report far outweighs that of hydrography. The enormous outpourings of lava which cover many hundreds of square miles in Idaho furnished abundant opportunity for a comprehensive discussion of the varied characteristics of lava flows, both in their broader aspects and minor details, and of the causes that gave rise to them. A detailed analysis by the reviewer of a typical basalt from the Cinder Buttes, which are close to the west border of the Snake River Plains, in their widest part, probably indicates "about the average composition of all the recent lava discharged from the Cinder Buttes." There is also an analysis by the reviewer of an aeolian soil covering the Snake River Plains at a distance from the mountains, which "consists essentially of exceedingly fine quartz sand, to which a small percentage of calcium carbonate, together with some vegetable matter, has been added," a statement contradicted by the analysis, despite the contrary belief of the author.

W. F. HILLEBRAND.

METALLURGICAL CHEMISTRY AND ASSAYING.

The Connellsville Region. By H. N. Eavenson. *Mines and Minerals*, August, 1902.—The writer is assistant chief engineer of the H. C. Frick Coke Co., and gives an accurate and interesting account of the mineral resources, methods of mining, quality of products, and amount of output, of the region, including a historical sketch of the iron industry which formerly flourished there. Typical analyses of the coal and coke, taking the average of hundreds of analyses from all over the region, show:

	Coal.	Coke.
Water	1.130	0.070
Volatile combustible matter	29.812	0.880
Fixed carbon	60.420	89.509
Sulphur	0.789	0.811
Phosphorus	0.010	0.014
Ash	7.949	9.830

J. W. Richards.

British Columbia Iron and Coal. By W. M. Brewer. *Mines and Minerals*, August, 1902. An interesting description of the various known deposits, their locations, qualities and extent of development. A peculiar condition is that the large deposits of iron ore on Texada Island, carrying 70 per cent. iron, phosphorus very low, not a trace of titanium and very little silica, are partly valueless because of a small percentage of copper, which is not enough to convert the material into copper ore. Sinking of shafts into these beds showed the copper to increase with the depth, but after the bed is passed, more recent shafts have disclosed underneath some exceedingly pure magnetite without a trace of copper. Crystalline limestone of great purity exists in close proximity to these iron deposits; an excellent coking coal is mined on the east side of Vancouver Island; the Canadian government pays a bounty of $2.00 per ton on pig iron made from native ores; and altogether the prospects are bright for a large development in this region.

J. W. Richards.

The Conversion of Amorphous Carbon into Graphite. By F. J. FitzGerald. *J. Frank. Inst.*, November, 1902. A 27-page paper on the history of this subject, giving copious translations from the original articles of Despretz, Berthelot, and Moissan, a connected history of the development of the Acheson manufactured-graphite process, and considerable new information on the chemical and physical properties of Acheson graphite. Amorphous carbon electrodes have a density before graphitizing of 1.90, and an electrical resistance of 0.00124 ohm per cubic inch; the same completely graphitized has a density of 2.19, and a resistance of 0.00032 ohm per cubic inch, or only one-fourth the

resistance. The latter figure represents 0.0008 ohm per centimeter cube. Castner's "Anode for Electrolytic Processes," patented in 1896, is described as nothing more than an electrically baked carbon ; and Borcher's experiments, showing that carbides further the crystallization of carbon, were made known long after Acheson's patents were published. J. W. RICHARDS.

Notes on Oil Furnaces for Assaying and Melting. BY C. BRENT. *Can. Min. Rev.*, June, 1902. Description of furnaces designed by the writer, using gasoline, refined oil or fuel oil, and which can be constructed by any ordinary mechanic. They are constructed of sheet steel, lined with a plastic mixture of 4 parts old assay crucibles, ground to 20 mesh, and 1 part of good finely-ground fire-clay. It burns as hard as porcelain and is practically indestructible. A combination crucible and muffle furnace is shown, also a combined melting and reverberatory furnace. In the simple crucible furnace the oil jets are applied on two opposite sides, tangentially. With air at 80 pounds pressure, the furnaces can be raised to assaying temperature in ten to fifteen minutes. J. W. RICHARDS.

The Hoover and Mason Ore-Handling System. *Iron Age*, September 4, 1902.—The most comprehensive ore-handling plant yet installed, which has been put into operation at the South Chicago works of the Illinois Steel Co. It unloads, stores, and sends to the stack, ore for two 500-ton furnaces. There is a battery of 15 unloading machines on the dock, and two large ore bridges, each 518 feet long, which span the whole space from the docks to the foot of the stacks. These bridges travel on two piers, 188 feet apart, the dock end projecting 150 feet and the stack end 180 feet. A 10-ton grab travels on the bridge. The bridges may not only move transversely, but one end may be moved while the other is fixed, allowing the bridge to be placed as far as 30° from its normal line. The bridges can deliver as much as 1000 tons of ore an hour into the ore-pockets or scale-cars at the foot of the stacks. Twenty-six men now do the unloading and charging work formerly done by 300. The article is copiously illustrated. J. W. RICHARDS.

Process of Smelting Iron Ore Fines. BY OSCAR DAUBE. *Eng. Min. J.*, October 4, 1902. The fine ore is mixed with coal dust or culm, and coked in a coking oven, producing a metallic sponge or coke ready for the blast-furnace. The concentrate contained 71.08 per cent. iron, 0.22 silica, 0.03 phosphorus, and 0.42 titanium. It was converted thus into a coke containing carbon 42 per cent., iron 37, limestone 13, and ash 8. Flue dust, fine roasted ores and soft Mesabi ores can be similarly treated. The coking takes twenty-four hours ; the gases are used to heat the oven and leave a surplus unused. If the coke is to be directly reduced to metal, a vertical oven holding 10 tons is used, the flux

is mixed with the coal and ore, the charge is coked, then the blast is forced in by tuyeres below, and the reduction takes place rapidly and molten metal and slag are tapped as from a cupola. When the furnace is empty, it is recharged for another operation.

J. W. RICHARDS.

New Plant for Handling Blast-Furnace Slag. *Iron Age*, October 23, 1902.—Many blast-furnaces are installing the system of running their slag into a brick-lined pit, where, as it enters, it meets with a flat jet of water which granulates it to the consistency of fine gravel. It is then dug out by a clam-shell grab, from an overhead traveler, the load allowed to drain, and then transferred directly to the cars. The operator rides in a cab suspended from the overhead rail, alongside of the bucket. The pit is large enough to hold a two-days run of cinder, and the trolley can make forty trips an hour, the bucket load averaging 1½ to 2 tons, loading 1½ gondola cars per hour. One man, working four to eight hours a day, can do the work of ten to twenty men handling the slag by hand. The bucket can be used also for other purposes around the yards, when not busy loading up slag.

J. W. RICHARDS.

Electric Welding of Rail Joints. *Iron Age*, September 25, 1902. Illustrated description of a portable plant for welding street-car rail joints, in place. The joint is cleaned by a sand blast, flat-rolled steel bars are placed across the joint, and a current of 25,000 to 30,000 amperes, at a pressure of 7 volts, is applied, pressure being simultaneously applied on each side of the joint. The current is then shut off, and the pressure is left on a little while, while the joint cools. The current is on two to two and a half minutes. The current is taken as direct current from the trolley wire, at 500 or 600 volts, transformed to alternating current of 300 volts, and this sent to the induction transformer. It takes about 225 amperes from the trolley wire, to produce the welding current, or about 125 kilo-watts. The preparing, welding and finishing of a joint take about twelve minutes. The number of failures of these joints, in actual use, is not over one in a thousand.

J. W. RICHARDS.

Electrolytic Refining of Base Lead Bullion. BY T. ULKE. *Eng. Min. J.*, October 11, 1902.—The process of A. G. Betts is in use at the Trail smelter, British Columbia. A plant treating 10 tons daily, valued at $15,000, has been operating successfully 10 months, and a 30-ton plant is contemplated. The process consists in using the impure lead as anode in an acid solution of lead fluosilicate. The solution is made by diluting 35 per cent. hydrofluoric acid with an equal volume of water and saturating it with pulverized quartz. This solution will take up about 6 pounds of lead per cubic foot; in actual work it contains about 8 per cent.

of lead and 11 per cent. excess of H_2SiF_6. The anodes are 2 inches thick, no anode sacks are used, there is no polarization or formation of peroxide on the anode, no evaporation of acid and no danger in handling, while exceptionally pure lead is deposited. The cathodes are thin lead plates (made in a separate depositing tank by precipitation on paraffined steel plates), the electrodes are 1 ½ to 2 inches apart, and the fall of potential is 0.2 volt, using 14 amperes current per square foot. A metric ton of lead can be deposited per day with less than 100 mechanical horse-power. The lead, zinc, iron, cobalt and nickel go into solution; the anode residue contains 10 per cent. of lead, and practically all of the copper, antimony, bismuth, arsenic, silver and gold contained in the bullion. The impurities accumulating in the solution are so small in amount that only a few per cent. accumulate in a year; about 10 cubic feet of solution are taken out daily and purified, thus keeping the electrolyte clean. The melted-down lead contains only traces of bismuth. The slimes carry 8,000 ounces of silver per ton, and are boiled with concentrated H_2SO_4 to remove copper, and then melted down with niter and antimonate of soda. There is room for improvement in the treatment of the slimes. The whole process is cheaper than the fire-refining processes now in use and more efficient, and signalizes a great advance.

J. W. RICHARDS.

Concentration of Copper Ore. *Mines and Minerals*, October, 1902. Description of the Elmore process, used in a mill concentrating 250 tons per week, and saving 80 per cent. of the values in the ore, whereas the best methods of concentration formerly used on that ore recovered only 11.5 per cent. The ore-pulp stream is agitated by screws with a small quantity of the thick, sticky oil residue from petroleum stills, and then flows into spitz-kasten. The particles of ore are wetted by the oil and float up as a scum, while the particles of tailings or rock are not wetted, and at once settle. The scum flows off to a centrifugal machine, where the bulk of the oil is extracted, and is ready for re-use. For close extraction, three mixing cylinders are used, with fresh oil introduced into each, and two centrifugals, to extract all the oil.

J. W. RICHARDS.

The Ducktown Copper Mining District. BY. S. W. MCCALLIE. *Eng. Min. J.*, October 4, 1902. An illustrated article on the geology and character of these well-known deposits. The ores are massive pyrrhotite impregnated with chalcopyrite and pyrite. The large quantities of black oxides and carbonates found at the water-level in the early workings, are exhausted. The present sulphide ore is yet in very large quantity, and, when roasted, runs 2 to 4 per cent. of copper. The gossan, or part of the ore body lying above water-level, is a porous iron ore, which has supplied large quantities of low sulphur and low phosphorus ore,

giving steady employment to from 75 to 150 miners. The sulphur, which constitutes 20 to 30 per cent. of the ore, and which is really its most valuable ingredient, is entirely wasted by the system of heap-roasting. A practical method for saving this as sulphuric acid is greatly needed. J. W. RICHARDS.

The Copper Mines of New Jersey. *Rep. N. J. State Geologist for 1901*, p. 150.—The copper mines of this state are not yet beyond the development stage; in certain localities there are large quantities of low-grade ore which can probably be worked profitably by modern methods of mining and treatment. At the American Copper Mine at Somerville, work has been carried on steadily during 1901, several thousand tons of ore have been mined, a portion has been concentrated with good results, several trial smeltings have been made, and a high grade of ingot copper produced. Extensive experiments were undertaken in leaching these ores, of which the following details are given by J. Bond, general manager of the mine: The tests were made on oxidized silicate ores containing up to 2.83 per cent. of copper. Extraction by dilute sulphuric acid showed maximum extraction by a solution a little stronger than 1 per cent., used a little over four hours. Cupric chloride solution gives almost complete extraction, but the action is slow and there is a tendency to form insoluble oxychlorides. Cupric chloride solution, however, *takes up gold and silver in lieu of, and in preference to, copper*, and was proved to secure a good gold extraction from a quartzose ore. The gold can be readily extracted from the solution by a feeble electric current. Sodium hyposulphite gives fair results in twenty-four hours when heated to 40° C. Hypochlorite of soda with an excess of chlorine gives good extraction but costs too much. Sulphurous acid gas in solution takes up too much foreign matter, and extraction is not complete. Sulphuric acid and salt, or hydrochloric acid, are cheap and feasible, an excess of salt being used. This dissolves silver, and gold also if potassium permanganate is added. Tailings can be economically leached if they run above 0.5 per cent. copper. Ores must contain 0.75 per cent. more, in order to pay costs of mining and pulverizing.

J. W. RICHARDS.

The Electrolytic Production of Copper and Nickel. BY TITUS ULKE. *Can. Min. Rev.*, June, 1902. The author's process consists in smelting argentiferous copper ore with heap-roasted nickeliferous Sudbury pyrrhotite ore, converting the matte in Bessemers to blister copper, and electrolytically refining this. The nickel must be less than 20 per cent. of the copper present, in order to avoid large losses of nickel in Bessemerizing. The blister copper can be thus produced with 95 per cent. of metal. During electrolysis, 2 per cent. of the electrolyte is removed daily, its nickel extracted by a chemical process, and the purified copper

solution returned to the baths. In this way, nickel is kept from accumulating in the electrolyte. The nickel is obtained in a sulphate solution, which is made slightly ammoniacal and electrolyzed with sheet-lead anodes and sheet-nickel cathodes, which are afterwards melted down to any shape desired.

J. W. RICHARDS.

The Refining of Canadian Nickel. By Special Correspondence. *Eng. Min. J.*, October 4, 1902.—Most of the Canadian ores are matted and then sent to the United States to be refined. The Thompson process of treating the matte has, however, lapsed in Canada as a patented process because of non-payment of patent fees, and the process is now open to any other company to use in Canada.

J. W. RICHARDS.

Production of Nickel Steel. *Eng. Min. J.*, October 4, 1902. —In an abstract of the yearly report of the Clergue Syndicate, operating at Sault Ste. Marie, the statement is made that nickel steel will be manufactured there by the following process: The nickel ore from the company's Sudbury mine, which is free from copper, is sent to Sault Sainte Marie, and there roasted in automatic furnaces. The sulphurous oxide fumes are utilized in the chemical wood-pulp mill. The roasted ore consists of oxides of iron and nickel, and is pressed into briquettes. Several thousand tons of these are already on hand. When the blast-furnaces now being built are in operation, these briquettes will be charged and run down to a nickeliferous pig iron. This will be used in Bessemer or open hearth furnaces, and there brought out as nickel steel. If the process proves feasible, it will be of considerable metallurgical interest.

J. W. RICHARDS.

Dipping Brass. BY E. S. SPERRY. *Al. World*, October, 1902. Pickling is the removal of oxide from metal, usually after annealing, by a weak acid acting slowly. Dipping is done by plunging into a mixture of strong nitric and sulphuric acids; the violent action lasts but a short time, and the surface is made perfectly clean, bright and uniform in color. Large quantities of brass articles, both in sheet and castings, are thus treated before going on the market. The requirements for good dipping brass are that the structure must be homogeneous, the metal free from blow-holes or streaks, the alloy uniformly attacked by the acid, and the castings free from sand or other adhering matter. Small blow-holes in a plate or bar, roll or draw out into streaks on the sheet or rod, and are very unsightly after dipping. Tin in the alloy has a tendency to liquate and form a composition not readily attacked by acid and hence resulting in a mottled surface. The more quickly the alloy is cooled the less the liquation and the less this effect; sand castings are therefore more likely to show this than sheet or rod, which are made by casting in iron molds.

Lead often acts likewise ; spots of unalloyed iron often appear in dipping ; and antimony often causes trouble. The purer the brass the better. Sand on the castings may be removed by a tumbling barrel ; if burnt in, pickling in hydrofluoric acid may be necessary. J. W. RICHARDS.

Mexican Planillas. BY E. E. PAYNE. *Mines and Minerals*, October, 1902.—The "planilla" is an inclined floor about 5 feet long by 5 feet wide, and closed on all sides by a dam, except at one lower corner. The ore to be washed or concentrated is passed through a ¼-inch screen, and 750 pounds spread uniformly on the floor. The operator then takes a *batea*, or washing pan, and with a peculiar swirling motion throws water on the ore. The lighter particles float off, and water is thrown on more and more cautiously. The ore is then turned several times, and when no more rock can be swept off without washing away ore particles, the concentrates are shoveled out. One man can wash seven charges a day, and is paid 75 cents per 300 pounds of concentrate. Ore with 5 per cent. lead will be concentrated up to 14 per cent., the tailings running 2 to 4 per cent. J. W. RICHARDS.

Mexican Methods of Silver Ore Treatment. BY J. N. NEVINS. *Eng. Min. J.*, October 18, 1902.—Illustrated description of a small patio plant. The photographs are very clear and interesting, showing a Chilean mill, a tahona or arrastra, a torta for the patio amalgamation, toneles for barrel amalgamation, and planillas for concentrating and washing the amalgam, with sectional diagram of the latter. J. W. RICHARDS.

Alaska Treadwell Gold Mine. *Eng. Min. J.*, October 25, 1902. —The report of this company for the year ending May 15, 1902, shows that 682,983 tons of ore were mined, at a cost of 83.99 cents per ton, that milling and concentrating cost 18.40 cents per ton, and treatment of the 12,660 tons of sulphuret concentrates 14.25 cents per ton. The amalgamation extracted 97.45 cents worth of gold per ton of ore, the treatment of concentrates 50.48 dollars per ton of concentrates, or 93.61 cents per ton of ore ; total recovery, 1.9106 dollars per ton of ore. The total expense account aggregated $1.2828 per ton, leaving a net profit of $0.6787 per ton, or $436,490 altogether. It is estimated that there is six years' supply of ore still in the mine. J. W. RICHARDS.

Treatment of Zinc Precipitate from Cyaniding Gold Ore. BY H. WINGATE. *Eng. Min. J.*, October 25, 1902. (Paper read before American Institute of Mining Engineers.)—The notes were taken at the Waitchauri Extended Mine, Maratoto, New Zealand. The precipitate is washed through a 40-mesh sieve, dried on a filter by a vacuum pump, weighed, and then roasted on a square cast-iron tray with 6-inch sides built over a brick furnace, burning wood. The tray has a hood and the fumes pass into

a dust chamber. The heat is low at first, and finished at a very dull read heat, great care being taken to avoid loss by dusting. 100 parts of oxidized precipitate are mixed with 50 parts anhydrous borax, 15 parts anhydrous sodium carbonate, and melted at a moderate heat in a No. 50 plumbago crucible. The mixture is added until the crucible is three-quarters full; then the heat is raised, and the slag ladled off into molds; then more of the mixture is added and the operation repeated until the crucible is about two-thirds full of melted bullion, which averages 941 fine, the base metals being zinc, lead, iron and copper. The slags were crushed in the mill and washed, giving a return equal to 1.5 per cent. of the bullion recovered. The fineness of the bullion is mainly due to the sieving of the precipitate at the start, by which short ends of zinc were removed and returned to the precipitation boxes.

J. W. RICHARDS.

The American Aluminum Association. *Al. World*, October, 1902.—An account of the proceedings of the second annual convention, held at Pittsburg, September 19 and 20. Reports were read from the committees on cooking utensils, combs, novelties, and metallurgy. The use for cooking utensils is growing, and the business flourishing; the manufacture of aluminum combs consumes a large part of all the sheet aluminum made and a systematization of the manufacture of novelties was urged. The Committee on Metallurgy reported that great activity exists in the production in this country; new bauxite deposits have been opened in Arkansas, and the purification of crude alumina has been improved by the Hall wet lime process. There is now 16,000 horse-power being used in America in producing the metal, which will shortly be increased by 12,000 H. P. The yearly output in America is at the rate of 4,500 tons, or twice that of the rest of the world.

J. W. RICHARDS.

Process of Manufacturing Alumina. *Al. World*, September, 1902.—Description of an electric-furnace process recently patented by C. M. Hall. A previous patent described the fusion of impure alumina, such as bauxite, with an amount of reducing material, such as carbon, sufficient to reduce the oxides of iron, silicon, and titanium present to the metallic state. There is a great deal of heat radiated in such operations, and to utilize this for the process itself it is proposed to subject the mixture, used as a lining or covering of the above furnace, to the diffused heat therefrom, whereby, without being fused, the mixture is heated to such a degree that the iron oxide is substantially reduced to iron, and the silica and titanium oxide partly reduced; the mass may frit somewhat together but remains porous, and the gases produced escape easily. The mass thus prepared is broken up and fused afterwards, in which operation the rest of the reduction of impurities is accomplished and the reduced iron and silicon agglomerated

into fused masses. A particular advantage thus gained is that the last trace of moisture, and most of the gases produced by reduction, are eliminated before fusion takes place, and the violent disturbance which these cause at the high fusion temperature is avoided. The fusion furnace has a perforated iron shell, put together in sections, and deeply lined with the mixture for reduction, the fusion of the previously heated mixture taking place inside. The hea ttransmitted from the fluid bath within bakes and partly reduces the mixture lining, and prepares it for being melted down completely in a succeeding operation.

J. W. RICHARDS.

Reduction of Metallic Oxides by Aluminum. BY F. C. WEBER. *Al. World*, November, 1902. Author patents the improvement in the Goldschmidt reduction process which consists in embedding in the mixture for reduction a coiled aluminum wire. By sending an electric current through this, the mixture may be heated to a moderate temperature for some minutes, and all trace of moisture driven out before the mixture reacts. The current is then increased until the wire melts and reaches a high temperature, when the charge will be ignited and will burn steadily without danger of explosion, since no moisture and but little air are left in the preheated charge. J. W. RICHARDS.

ORGANIC CHEMISTRY.

On the Preparation and Reactions of Formamidine Derivatives. BY F. B. DAINS. *Ber. d. chem. Ges.*, 35, 2496–2511.—By the action of dichlormethylformamidinechloride upon primary amines, formamidine and substituted formamidines are easily obtained, the reaction being as follows:

$$HN:CH.NH.CHCl_2.HCl + 2R.NH_2 =$$
$$NH:CH.NH_2.HCl + RN:CH.NHR.HCl + HCl.$$

EXPERIMENTAL.—Various amines were employed in the above reaction. *With aniline.*—Product, *diphenylformamidine; chloride* crystallizes from water with three molecules H_2O. *With m-Nitraniline.*—Products, *di-3-nitrophenylformamidine*, m. p. 200°, and *m-nitroformanilide*, m. p. 135°. *With p-Nitraniline.*—Product, *di-p-nitrophenylformamidine*, m. p. 236°. *With o-Nitraniline.*—No reaction. *With p-Chloraniline.*—Product, *di-p-chlorphenylformamidine*, white needles, m. p. 179°, easily soluble in benzene, decomposed by alcohol; *picrate*, fine, yellow needles, difficultly soluble, melt with decomposition at 242°. *With o-Toluidine.*—Product, *di-o-tolylformamidine*, m. p. 151°. *With m- and p-toluidines* the corresponding *m- and p- tolylamidines* are obtained. *With m-Xylidine.*—Product, *di-m-xylylformamidine*, fine

white needles (from benzene), m. p. 131°, difficultly soluble in boiling hydrochloric acid ; *chloride*, fine crystalline precipitate (from benzene), melts with decomposition at 243°; *chlorplatinate*, melts with decomposition at 201° ; *picrate*, m. p. 228°, very little soluble in alcohol. *With nitro-m-xylidine* ($CH_3 : CH_3 : NH_2 : NO_2 =$ 1 : 2 : 4 : 5).—No reaction. *With pseudocumidine*, the *corresponding amidine* is produced, fine, white needles, m. p. 160°, easily soluble in hot benzene, very difficultly soluble in boiling hydrochloric acid ; *chloride*, m. p. 236°, very difficultly soluble in hot water. *With α-naphthylamine.*—Product, *di-α-naphthylformamidine*, which is decomposed by hot alcohol with formation of *α-formnaphthalide*, m. p. 137°. *With β-naphthylamine.*—Product, *di-β naphthylformamidine*, fine, white needles (from benzene), m. p. 186°, easily soluble in the ordinary solvents. The same amidine was obtained by the interaction of ethylorthoformate and β-naphthylamine. *With p-aminophenol.*—No reaction. *o-* and *p-Anisidine* and *p-phenetidine* give the *corresponding amidines*. *With p-aminoazobenzene.*—Product, the *formamidine of p-aminoazobenzene*, m. p. 190°. *With phenylhydrazine.*—Products, aniline, *formazylhydride* ($C_6H_5.NH.\ N : CH.N.C_6H_5$), and a small amount of a *base*, m. p. 114° (from ether-ligroin), which is possibly $C_6H_5.N : CH.NH.NH.C_6H_5$. *With o-phenylenediamine.*—Product, *benzimidazol*, $C_6H_4\Big\langle{}^{NH}_{N}\Big\rangle CH$, m. p. 170°. *With benzidine.*—No formamidine produced. The majority of the reactions were conducted in benzene solution. No similar condensations could be obtained with secondary or tertiary bases.

REACTIONS OF FORMAMIDINES.—Amidines of : N.CH : N type react with substances containing an unsubstituted methylene CH_2 group as follows :

$$RNH.CH : NR + H_2C\Big\langle{}^{Y}_{X} = RNH.CH : C\Big\langle{}^{Y}_{X} + RNH_2,$$

thus permitting the preparation of aminomethylene derivatives from acetacetic ester, acetylacetone, etc. EXPERIMENTAL.—*Anilidomethyleneacetylacetone*, $C_6H_5.NH.CH : C(COCH_3)_2$, was prepared from diphenylformamidine and acetylacetone. *p-Toluidomethyleneacetylacetone* and *m-xylidomethyleneacetylacetone* were prepared in similar manner. The latter is new, and forms long, hairy needles (from dilute alcohol), m. p. 146°, very easily soluble in ordinary solvents. *Anilidomethylenebenzylcyanide* and *p-toluidomethylenebenzylcyanide* were prepared from the corresponding amidines and benzyl cyanide; the latter crystallizes from glacial acetic acid in light brown needles, m. p. 135°. *m-Xylidomethylenebenzylcyanide*, crystals (from glacial acetic acid), m. p. 130°, easily soluble in ordinary solvents. *Monoanilide of anilidomethylenemalonicethylester*, $C_6H_5NH.CH:C(COOC_2H_5)$

$(CO.NHC_6H_5)$, was obtained from diphenylformamidine and malonic ester in sealed tubes at 150°. The corresponding *o-tolyl derivative* forms crystals (from alcohol and glacial acetic acid) which melt at 141°, and are nearly insoluble in cold alcohol, difficultly soluble in hot, but quite easily in hot glacial acetic acid; boiled with alcoholic sodium hydroxide, $CH_3.C_6H_4.NH.CH : C(COOH)CO.NH.C_6H_4.CH_3$ is obtained. The latter forms fine needles, which melt at 161° with loss of CO_2, difficultly soluble in alcohol, easily soluble in alkalies only when freshly prepared. A solution of the ammonium salt gives white precipitates with solutions of salts of silver, calcium, barium, etc. By heating the acid to 165° as long as CO_2 is evolved, the *o*-toluide of *o*-toluido-acrylic acid is formed (not obtained pure). *p-Tolyl derivative*, crystallized from glacial acetic acid, m. p. 168°, very difficultly soluble in ordinary solvents, may be saponified to an acid melting at 187°. *m-Xylyl derivative*, fine, white needles, m. p. 147°, soluble in alcohol or glacial acetic acid. *Pseudocumyl derivative*, m. p. 180°, very difficultly soluble in alcohol, more readily in hot glacial acetic acid. *p Chlorphenyl derivative*, m. p. 176°, difficultly soluble in hot alcohol or cold glacial acetic acid, more readily in hot glacial acetic acid. *p-Anisyl derivative*, m. p. 130°, easily soluble in alcohol, ether or glacial acetic acid. *Anilide of anilidomethyleneacetaceticester*, $C_6H_5NH.CH : C(COCH_3)(CONHC_6H_5)$, was produced from diphenylformamidine and acetaceticester; needles (from alcohol or glacial acetic acid), m. p. 156°. The anilide of oxymethyleneacetaceticester, m. p. 45°–46°, $C_6H_5NH.CH : C(COCH_3)(COOC_2H_5)$, was also present. The former (m. p. 156°) was also prepared by the interaction of diphenylformamidine upon acetaceticanilide. *o-Tolyl derivative*, needles (from glacial acetic acid), m. p. 172°, difficultly soluble in alcohol; a *substance* which separated from the liquid in crystals, m. p. 171°, was also observed, and was probably the toluidomethyleneacetaceticester. *p-Tolyl derivative*, needles (from glacial acetic acid), m. p. 170°. *p Xylyl derivative*, m. p. 188°. *Anilidomethylenecyanaceticester*, $C_6H_5NH.CH : C(CN)COOC_2H_5$, from diphenylformamidine and cyanaceticester, m. p. 106°–107°; by the action of bromine in glacial acetic solution, a bromine derivative, m. p. 148°, was formed. *p-Tolyl-derivative*, m. p. 137°, easily soluble in alcohol or glacial acetic acid. *o-Tolyl derivative*, m. p. 137°–138°. *Pseudocumyl derivative*, m. p. 195°. Most of the above condensations were obtained by heating the compounds together for several hours at 150°. Benzoylacetone and desoxybenzoin react with formamidines in a similar manner. M. T. BOGERT.

Triphenylmethyl. A Contribution to Our Knowledge of the Carbonium Salts (Fifth paper). BY M. GOMBERG. *Ber. d. chem. Ges.*, 35, 2397–2408.—*Molecular weight of triphenylchlor-*

methane. Cryoscopic determinations of the molecular weight in benzene solution give no indication of any dissociation, while the results of the ebullioscopic method indicate an association rather than a dissociation. *Formation of perhalides* by the triphenylhalogen methanes shows the salt-like nature of these substances. The *ability to form double salts* is strongly marked in the triphenylmethanes. The production of colored double salts is not, however, due to molecular rearrangement in the sense suggested by Kehrmann. The *action of sulphuric acid* upon triphenylchlormethane gives a sulphate, $(C_6H_5)_3C.HSO_4$, to which the yellow color of the solution is due. Triphenylcarbinol is a weak base, and by the action of dry hydrochloric acid gas upon its solution in dry ether or dry benzene it yields the chloride, with separation of water, the reaction being a reversible one. *Carbonium salts.* Triphenylbrommethane with silver sulphate, in benzene solution, gives a red compound, possibly the normal salt $((C_6H_5)_3.C)_2SO_4$, and probably analogous to the compound obtained by von Baeyer and Villiger from trianisylchlormethane and silver sulphate. Triphenylchlormethane gives a yellow compound with silver sulphate, but the product is difficult to purify; it also gives colored compounds with the silver salts of nitric, hydroferrocyanic, tungstic, arsenic, and other acids. *Triphenylchromate* is easily formed. It is yellowish-red, crystalline and stable, blackens at 145°, and melts at 174°. Triphenylcarbinol likewise gives colored bodies with various mineral acids. *Halochromism of triphenylmethyl.* The author believes that he has proved experimentally that triphenylmethyl is colorless in the solid state but yellow in solution. The ether and ester derivatives are colorless, the yellow color of their solutions being due to a partial dissociation into triphenylmethyl and ether again. The relation existing between the solid triphenylmethyl and triphenylmethyl in solution is likened to that between a chemical element and its ions, the yellow color of the solutions of triphenylmethyl being due to the presence of the "pseudions" $(C_6H_5)_3\overset{+}{C} + (C_6H_5)_3\overset{-}{C}$. As the molecular weight determinations, however, give no support to the conception of an ionization of the substance, the phenomena are referred to a "pseudodissociation." As the author states, it seems strange that triphenylchlormethane is colorless even in solution, for if the yellow salts of triphenylmethyl owe their color to the pseudiontriphenylmethyl, the chloride should also be yellow, since the readiness with which its solution reacts with metals renders it probable that it is split into the ions or pseudions, $(C_6H_5)_3\overset{+}{C} + \overset{-}{Cl}$. The behavior of triphenylhalogen methanes was investigated with various solvents, with the result that the chloride and bromide were found to give beautiful yellow solutions with many solvents. Ethyl acetate, benzene and ether gave negative results, but colored solutions were obtained with benzonitrile, acetyl chloride,

sulphuryl chloride, and liquid SO_2. The conductivity is recorded for certain of these solutions. The foregoing facts lead to the conclusion that the triphenylhalogens are true salts. Triphenylcarbinol gives salts with concentrated acids, which dissolve in the acids with formation of yellow triphenylmethyl ions. With metallic salts triphenylhalogenmethanes give double salts which are colorless in the solid or dissolved condition, and the structure of which is, *e.g.*, $(C_6H_5)_3CCl\langle^{Cl}_{ZnCl}$. In line with the above deductions, based upon the color of the triphenylmethyl ion, an explanation is suggested for the cause of color in the triphenylmethane dyes; the color of Malachite Green, for example, is due to the ion $((CH_3)_2N.C_6H_4)_2(C_6H_5)C'$, the formula for the chloride being similar to that advanced by Rosenstiehl for pararosaniline. The name "carbyl salts" is proposed for the compounds discussed in this paper as being preferable to "carbonium salts;" the latter designation can then be reserved for salts in which the carbon has an increased valence (like ammonium, iodonium, oxonium, etc., salts). In the course of the work, a new *tritolylmethane*, m. p. 63.5°, was prepared. M. T. BOGERT.

BIOLOGICAL CHEMISTRY.

Hydrolysis of Triacetylglucose by Enzymes. BY S. F. ACREE AND J. H. HINKINS. *Am. Chem. J.*, **28**, 370–387.—This article is a preliminary communication, the results of which, taken in connection with a former paper (*Dental Cosmos*, June, 1901), tend to prove that esters can be formed from triacetylglucose by bacteria. It is very probable, it is suggested, that further experiments will show decisively that enzymes can form glucose acetates from, as well as hydrolyze them into, glucose and acetic acid. F. P. UNDERHILL.

Notes on the "Protagon" of the Brain. BY W. W. LESEM AND WILLIAM J. GIES. *Am. J. Physiol.*, **8**, 183–197.—The brains employed in these experiments were those of sheep recently killed. The conclusions drawn are that the protagon of the brain is a mixture of substances, not a chemical individual. The mixture called protagon does not contain the bulk of the phosphorized organic substance of the brain. F. P. UNDERHILL.

The Effect of Diminished Excretion of Sodium Chloride on the Constituents of the Urine. BY R. A. HATCHER AND TORALD SOLLMANN. *Am. J. Physiol.*, **8**, 139–155.—These experiments were carried out on two patients, suffering from typhoid fever. The results show that the disappearance of the chlorides from the urine does not lead to any large changes in the other

urinary constituents—not sufficient at least to alter the physical properties of this fluid. Nor does the administration of sodium chloride produce such changes. Several practical considerations are given attention as a result of these experiments. According to the school of v. Karanyi, heart disease can be diagnosed from a high $\frac{\Delta}{NaCl}$ (the ratio of total molecules to chloride molecules) joined with a low $\Delta \times$ cc. (daily molecules). The results of the present experiments show that the same changes result, in at least an equal degree, from a milk diet. The addition of sodium chloride to a milk diet results in a greater excretion of urine and metabolites. The latter are at the same time diluted. The retention of chlorides shows that the body requires a certain amount of sodium chloride, which is not supplied by the insufficient quantity of this substance contained in the milk. For these reasons the addition of sodium chloride to a milk diet appears commendable. The salt may be added directly to the milk without inconvenience. It should be distributed so that about 15 grams are taken per day.

F. P. UNDERHILL.

The Mechanism of the Retention of Chlorides: A Contribution to the Theory of Urine Secretion. BY TORALD SOLLMANN. *Am. J. Physiol.*, 8, 155–175.—The disappearance of chlorides from fever urines is due, practically, entirely to the deficiency of chloride income. The mechanism of the retention of chlorides is not explained by any physical theory, but must be a vital process. Lessened secretion and increased reabsorption are probably both concerned in the retention. The filtration theory of urine formation is inadequate.

F. P. UNDERHILL.

On the Growth of Suckling Pigs Fed on a Diet of Skimmed Cow's Milk. BY MARGARET B. WILSON. *Am. J. Physiol.*, 8, 197–213.—Skimmed cows' milk, with or without 2 to 3 per cent. of added lactose or dextrose, is normally absorbed by suckling pigs. Two pigs fed on skim-milk from fourteen to sixteen days gained 26.4, and 66.8 per cent. in weight. Two pigs fed on the same skim-milk, with 2 and 3 per cent. of lactose added, gained 79.7 and 88 per cent. in weight. Two pigs fed on the same skim-milk, with 2 and 3 per cent. of dextrose added, gained 73.6 and 64.4 per cent in weight. Those fed with plain skim-milk gained 114 and 218 grams in weight for every 1000 physiologically available calories in the food. The lactose pigs gained 222 and 215 grams per 1000 calories in the food. The dextrose pigs gained 213 grams per 1000 calories in the food. Except in the case of one ill-nourished skim-milk pig, the growths of the sucklings stand in a constant ratio to the calories in the food. The pigs fed on plain skim-milk used 23 and 35 per cent. of the proteid in the food for tissue growth, the lactose pigs used 38 and 44 per cent., and the dextrose pigs 48 and 42 per cent. All the pigs of

the second litter gained in fat when on plain skim-milk or on skim-milk with sugars. The percentage of calcium in the bodies of the pigs diminished with their growth. There was considerable and normal deposition of calcium in the pig, and this was proportional, not to the calcium in the food, but to the growth of the animal. Not only is the growth in grams of the pigs proportional to the calories in the food, but the number of calories retained in the tissue substance during growth is proportional to the calories in the food. Eighteen to nineteen per cent. of the calories in the food were found stored in the tissue growth of the pigs fed on the three varieties of skimmed milk. There seems to be striking evidence that the suckling pig reared on skimmed cows' milk conforms to the same laws of nutrition as the breast-fed infant. F. P. UNDERHILL.

Does Potassium Cyanide Prolong the Life of the Unfertilized Egg of the Sea-Urchin? BY F. P. GORHAM AND R. W. TOWER. *Am. J. Physiol.*, 8, 175–183.—The action of potassium cyanide is only an indirect one, *i. e.*, killing or inhibiting the bacteria, and thus giving the eggs a more favorable environment. In all experiments with unsterilized sea-water, the protozoa enter as an important bacteria-destroying factor which must be considered in interpreting the results. Sterile sea-water "prolongs" the life of the egg of the sea-urchin much longer than Loeb's most favorable potassium cyanide solutions. Both the present experiments and those of Loeb's show that too strong solutions of potassium cyanide, and too long exposure to weak solutions, soon kill the egg. From this the reasonable interpretation is, that the potassium cyanide is a poison for all living matter, but it acts more quickly on bacteria than on sea-urchin eggs; it is in no sense a prolonger of life. From the fact that unfertilized eggs can be kept in sterile sea-water for eleven days or longer, it would seem that the specific mortal processes of Loeb's are as yet hypothetical phenomena without any definite experimental basis.

F. P. UNDERHILL.

SANITARY CHEMISTRY.

A Study of the Self-Purification in the Sudbury River, Massachusetts. BY C. E. A. WINSLOW, A. G. WOODMAN, AND PAUL HANSEN. *Tech. Quarterly*, 15, 105–126 (1902).—The Sudbury River, the authors state, is in dry seasons a small stream polluted at one point, Saxonville, to an extent of about 2 per cent. of its total volume by a liquid, manufacturing waste, three to five times as strong as ordinary city sewage. For 16 miles below this point no additional pollution enters, and at times of low water, comparatively little dilution occurs, and the flow is as a rule very sluggish,—conditions favorable to self-purification. Collec-

tions of samples were made on two different occasions, the first time at 10 points and the second time at 12 points along the 16 miles mentioned, and the samples were analyzed both chemically and bacterially. The results are given in tables, also plotted and curves drawn. The authors summarize the results obtained as follows: "The sewage of the Saxonville Mills, on the days observed, introduced into the Sudbury River a considerable amount of nitrogenous matter in the form of albuminoid ammonia, a considerable amount of mineral matter appearing mainly as fixed residue and hardness, and great numbers of bacteria, many of them thermophiles with some intestinal bacilli. During the 6 miles between Stations 11 and 7, organic pollution decreased and practically disappeared, at first rapidly, later more gradually. The thermophilous bacteria were removed during the same period. The total number of bacteria present was also greatly reduced, but remained distinctly above the normal during the sluggish flow of the stream to Station 4, 4 miles below. The colon bacillus also persisted in appreciable numbers down to Station 4.

"It appears then that, under certain conditions bacteria, and even intestinal bacteria, may persist in a stream after self-purification from organic material has been effected; and that they may be found, even in a very sluggish stream, at a distance of 10 miles below their point of entrance." LEONARD P. KINNICUTT.

The Second Report of the Royal Commission of Sewage Disposal. *Eng. News*, **48**, 291–298.—This is a review of the report issued July 7, 1902. The first report of the Royal Commission appointed in 1898, "to inquire and report what methods of treating and disposing of sewage, including any liquid from any factory or manufacturing process, may properly be adopted," was published in 1901 and consisted mainly of preliminary conclusions.

The second report is a collection of ten reports made by chemists and bacteriologists appointed by the commission.

The opening report is by Mr. Colin C. Frye, "The Oxidation of Stale Sewage," and shows that the oxidation of sewage free from bacteria is very slow and that the oxidation due to the oxidation by the oxygen of the atmosphere is unappreciable. The report or reports on the "Manchester Experiments of Treating Sewage" are made by Prof. R. Boyce, Dr. McGowan, and Mr. Colin C. Frye and, on the whole, are favorable. In regard to the septic tank, Prof. Boyce states: "A combination of the anaërobic and aërobic processes is better than the aërobic alone, but the septic process must be made more perfect than at present and suspended sludge must be prevented from passing over on to the beds;" "That it has not yet been proved definitely whether the septic tank is the best means of bringing about the sedimentation and destruction of the solid matter in the sewage, and although the

sludge problem is not eliminated by the septic tank, yet the sludge which the tank produces was not, at Manchester, so prone to decomposition as the sludge from chemical precipitation." The gain in capacity of contact beds after resting, Mr. Frye believes to be due mainly to mechanical shrinkage of the spongy mass present and only in a lesser degree to oxidation, though oxidation does go on actively when a bed is resting. The report on "The Bacteriology of Crude Sewage and Sewage Effluents and Standards for Potable and Non-potable Streams" is made by Dr. A. C. Houstan, and is divided into the following heads: Bacteria in Crude Sewage; Bacteria in Effluents from Artificial Processes; Bacteria in Effluents from Land Treatment; Bacteria in Effluents from Chemical Treatment; Standards for Effluents to be Discharged into Drinking-water Streams; Standards for Effluents Discharged into Non-drinking-water Streams. In this report it is stated that crude sewage contains at least 1,000,000, and often 10,000,000 bacteria per cubic centimeter, while the number of *bacilli coli communi*, or other closely allied intestinal forms, is apt to be at least 100,000 per cubic centimeter, and streptococci seem to be present to the number of at least 1,000 per cubic centimeter. That the effluents from septic tanks, contact beds, continuous filtration beds, etc., also contain an enormous number of bacteria, and though in some cases the percentage reduction of numbers in the effluent as compared with raw sewage is striking, yet the bacteria contents of crude sewage and effluents both in number and species appear to be very much the same, and the reduction in no case is seemingly so marked as to be very material from the point of view of the epidemologist. That the effluents from bacteria beds are bacteriologically so impure that they may well be excluded from streams that are used for drinking purposes. That the effluents from land treatment, broad irrigation are not, as a rule, fit to be turned into a potable stream, and though effluents can be obtained which in themselves might actually be regarded as potable water of more than average purity. The effluents generally contain coli, enteriticidis, sporogenes, and streptococci. That the effluents from chemical treatment, though there does not exist sufficient evidence to form an exact judgment, seem to contain about the same number of bacteria as the raw sewage. As a tentative standard for effluents discharged into potable waters, Dr. Houston suggests that they should be "free, or nearly so, from putrescible matter, as judged by chemical standards, and be free from the specific germs of epidemic diseases as judged indirectly, but seemingly in a safe fashion, by the absence of *B. coli*. It might be convenient to fix some limit, *e. g.*, that *B. coli* must be absent from 1 cubic centimeter of a sewage effluent." As a standard for effluents discharged into non-potable waters, Dr. Houston inclines to the belief, "that in the case of non-drinking streams, except where oysters and other shell-fish are taken to be

eaten raw, the bacteriological character of the effluent is of secondary importance. But even from this secondary point of view the bacteriological examination may be of considerable utility for ascertaining the actual or potential putrescibility of an effluent." Reports by Dr. Houston on "A Study of Anthrax Bacilli in Yeovil Sewage," on the "Subcutaneous Inoculation of Animals with Crude Sewage and other Effluents," "Some of the Chief Methods Used in the Bacteriological Examinations of Sewage and Effluents by Bacteriologists," and the report of Alfred MacConkey on "The Longevity of the *Bacillus Typhosus* in Sewage and Sewage Effluents" are of especial interest to bacteriologists, though Dr. Houston's report on methods used in the bacteriological examinations of sewage and effluents should be read by all chemists engaged in sanitary work. The report of Prof. Boyce on the "Effect of Filtration on Reducing the Number of Bacteria in the Effluent from a Dibden Contact Bed" is a description of experiments made with effluent from a contact bed at the West Derby Sewage Farm and the conclusions reached were "when an effluent containing upon an average of 800,000 bacteria per cubic centimeter and 10,000 *B. coli* per cubic centimeter is passed through a depth of 4 feet of soil at a slow rate, *viz.*, between 189,000 and 470,000 imperial gallons per acre per day, there is a very great reduction of the total number of bacteria and in the number of *B. coli*, and the chances of a very pathogenic germ bacterium like the *B. Typhosus* in the filtrate must be exceedingly small." The report on the "Pollution of the River Severn in the Shrewsbury District," by Prof. Boyce, Drs. MacConkey, Grünbaum and Hill, and the report on the "Self-Purification of the River Severn," by Mr. Frye, contain some very interesting results which can hardly be brought out in any brief statement.

LEONARD P. KINNICUTT.

Inorganic and Organic Sources of Contamination of Water Supplies. BY E. STARZ. *Jour. Ass. Eng. Soc.*, **29**, 122–141 (1902).—An account of the various inorganic and organic substances found in contaminated water, including living animal and vegetable organisms. Under inorganic substances it is noted that in a mining region, sulphides of arsenic, antimony, copper, lead, and zinc, are often found in suspension in the water, derived not from the soil but from the smelter slacks, while the hydrated oxide of iron is usually due to the decomposition of iron pyrites in the soil. Under organic contamination the paper takes up not only the subject of bacterial contamination, but describes carefully, giving drawings, the principal diatoms and protozoa that are found in polluted waters. LEONARD P. KINNICUTT.

A New Turpidemeter. BY CHARLES ANTHONY, JR. *Engineering News*, **48**, 220 (1902).—A description with drawing of a new instrument for determining the turpidity of water, sent

with a paper by Mr. Anthony, of Glenview, Hereford, England, which was read at the annual meeting of the New England Water Works Association. The instrument consists of two parallel tubes 50 cm. long, and an eye-piece. One of the tubes contains the water and is closed at the ends by plates of glass; the other tube contains a Nicol prism. Light transmitted through ground glass reaches the eye in part through the water, and in part through the Nicol prism and is observed through the eye-piece which contains a rotating Nicol prism. By rotating the prism, the illumination from the two sources of light can be compared.

LEONARD P. KINNICUTT.

Sewage Disposal at West Bromwich, England. BY A. D. GREATOREX. *Eng. Record*, 46, 394–395 (1902).—The sewage of West Bromwich amounting to 1,200,000 imperial gallons per day is rather a dilute sewage, containing little manufacturing waste, except a certain amount of brewery refuse, as no acid or wash-waters from galvanizing works are allowed to be discharged into the sewers. Three years ago the town council of West Bromwich, England, caused three large contact beds to be constructed to determine whether sewage like that described could be successfully treated by the contact bed method, at all times of the year, and to determine whether by means of double contact, an effluent could be obtained of sufficient purity to render unnecessary any further purification. The results of this investigation has been published by A. D. Greatorex and the conclusions drawn are: (1) That the sewage of West Bromwich can be successfully treated by bacterial process; (2) that the process is efficacious at all times of the year; (3) that the final effluent from the second contact fine-grained bed is sufficiently pure to be discharged into the stream; (4) that detritus tanks should be provided for removal of suspended matter before the sewage is run upon the beds. The report has been accepted by the town council, and the method of double contact beds has been decided upon for the purification of sewage of this locality.

LEONARD P. KINNICUTT.

Report of Sanitary Chemical Water Analyses. BY EDWARD BARTOW. *Kansas University Science Bulletin*, 1, 99 (1902).—This paper consists of 250 analyses arranged in 12 tables. These analyses, made in great part by the students of the university, are of the water of the Kansas River, at Lawrence, of certain wells and cisterns in Lawrence and its near vicinity, of a few springs and artesian wells, and of some rivers in Kansas, names not given. The methods used were those recommended by the Massachusetts State Board of Health. The most important conclusion drawn by the author from the analyses is that a normal "chlorine map" for the region around Lawrence would be very

difficult to make, and, if made, valueless, for chlorine alone can not in that region be used as a test for contamination.

LEONARD P. KINNICUTT.

Septic Tank at Bradford, Indiana. BY G. HOUSTAN. *Eng. Record*, **46**, 465 (1902).—A description with drawings of a large septic tank at Bradford, Indiana. At the inlet end of the tank are two detritus tanks 27 by $7^1/_2$ feet, and 8 feet deep. The septic tank is a closed cement concrete tank 46 by 17 feet and $7^3/_4$ feet deep, divided by plank divisions into three longitudinal compartments so as to be able to vary the time of flow of the sewage through the tank. LEONARD P. KINNICUTT.

Intermittent Filtration Sewage Plant at Ridgefield, Connecticut. BY T. H. MCKENZIE. *Eng. News*, **48**, 342 (1902).—The plant consists of $3^1/_2$ acres of intermittent sand filtration beds, and is adapted for the purification of the sewage of a village of about 3,000 inhabitants. LEONARD P. KINNICUTT.

Report upon the Experimental Filtration of the Water Supply of Springfield, at Ludlow, Massachusetts, from December 21, 1901 to January 1, 1902. BY H. W. CLARK. *Twenty-First Annual Report of the Massachusetts State Board of Health*, p. 198. —The water supply of Springfield, Massachusetts, has never been satisfactory on account of the odor and taste of the water, which are particularly obnoxious during certain seasons of the year, especially during August and September, and these experiments were made to see if the odor and taste could be removed by sand filters, working at a practical rate of filtration. The filters used in the experiments, eight in all, were small, the largest having an area of $^1/_{200}$ of an acre, the smallest $^1/_{20,000}$ of an acre. Sands of different effective sizes were used, and the depth of the sand in the various filters varied from 2 to 5 feet. The rate of filtration ranged from 1,000,000 to 5,000.000 gallons per acre per day. The method of working the filters, their action under different conditions, and the results obtained during the year are fully described. All analytical data are tabulated. The general result of the experiments showed that all positive odors could be removed by single filtration, except during the period from July 21st, to September 17th, when the number of Anaboena in the water of the reservoir was very large. During this period single filtration through sand-filters at the rates of 2,500,000 and 5,000,000 gallons per acre per day failed to remove the odor and taste, but double filtration, even when the secondary filter was operating at the rate of 10,000,000 gallons per acre per day removed all odors and all taste. LEONARD P. KINNICUTT.

Bacteriological Studies at the Lawrence Experimental Station, with Special Reference to the Determination of B. Coli. BY STEPHEN DEM. GAGE. *Twenty-First Annual Report of the*

Massachusetts State Board of Health, p. 398.—An account of the changes in the Lawrence method of determining *B. coli* and the methods now used. LEONARD P. KINNICUTT.

The Action of Water on Lead and Other Metallic or Metal-Lined Pipes. BY H. W. CLARK AND FRED B. FORBES. *Eng. News*, **48**, 303 (1902). A review of the paper on this subject, published in the *Twentieth Annual Report of the Massachusetts State Board of Health*.—The general conclusions of the authors of this paper are that the use of lead service pipes, especially in connection with ground water supplies containing considerable free carbonic acid, should be avoided wherever possible, and that, if a cement-lined iron pipe is not employed, a tin, or properly constructed tin-lined pipe with a considerable thickness of tin, is the safest and best for general use. It is evident that brass pipe is acted upon but slightly by most of the waters examined, but copper salts are considered to be more harmful than salts of tin.
LEONARD P. KINNICUTT.

As to the poisonous nature of lead the Report of the Massachusetts State Board of Health for 1898, stated : "The exact amount of lead which may be taken into the system without producing harm is not definitely known, and may vary with different persons but it is known that the continuous use of water containing quantities of lead as small as 0.05 part per 100,000 or about $^1/_{33}$ grain per gallon, has caused serious injury to health."
LEONARD P. KINNICUTT.

INDUSTRIAL CHEMISTRY.

The Development of the Bituminous Macadam Pavement. BY FRED WARREN. *Amer. Gas Light Journal*, October 25, 1902.—The writer describes the new pavement made available for practical use by the efforts of the Warren Bros. Co., and compares it with the ordinary sheet-asphalt pavement. The principles on which the bituminous-macadam pavement wearing surface is combined is the reverse of the principles on which the ordinary asphalt pavement is built. In the present asphalt or tar pavement, the bituminous cement is used to support fine mineral grains, such as sand, which in themselves have no firmness to sustain traffic, in such a way that the fine mineral grains will be held or supported by the bituminous cement, so that the mortar or mastic will, at all atmospheric temperatures, sustain the weight of traffic and at the same time resist abrasion. The bituminous macadam is built on the principle that. independent of the bituminous cement, relatively coarse and fine mineral grains should be combined in such a way as to have a firmness in themselves to sustain the weight of traffic. The bituminous cement is supported

or held in place by the proper arrangement as to size of the stone particles. The bituminous cement is used solely for the purpose of preventing attack on the stone from water and weather, and to bind the particles together sufficiently to prevent abrasion from traffic at all atmospheric temperatures and at the same time to provide an elastic bituminous cement or cushion between the mineral particles, which will deaden the jar and prevent the wearing effect caused by friction from the movement of the integral parts. The advantages which have already been demonstrated in practice are: (1) The preventing of the shifting or rolling of the ordinary asphalt pavement, due to the rolling during warm weather of the surface upon the concrete base and of the particles of fine sand upon each other when the bitumen becomes plastic; (2) a far greater density can be obtained in the new construction by using both coarse and fine broken stone in admixture with the voids thus reduced to a minimum, and these then filled with the bituminous cement; (3) the combination macadam and bituminous surface is one of the most durable known and sufficiently rough to give an ideal foothold for horses. In the city of Pawtucket, R. I., the pavement has been in successful use since May, 1901, on a street with a grade of 12 per cent., and has received the endorsement of all engineers and road builders who have seen it. S. P. SADTLER.

The Timber-Preserving Plant of the Alamogordo Lumber Company, Alamogordo, N. M. *Eng. News*, October 23, 1902.—This is a plant for applying a preservative treatment to railway ties, bridge timbers, paving blocks, electric light poles, and timber generally. The process used is the Wellhouse (zinc chloride and tannin). In the retort containing the charge of wood, steam is first admitted at 250° F., or 20 pounds pressure. This is kept on from two to five hours, according to the condition of the timber. The water of condensation is blown out and examined from time to time until it appears measurably free from sap. The pressure is then taken off and the cylinder allowed to partially cool. A vacuum of about 23.5 inches is then created and maintained for an hour. This causes the softened and dissolved sap and vapor to be drawn out. The zinc chloride is then run in and a pressure of 100 pounds per square inch created by force-pumps. The pressure is maintained for from two to four hours. The average amount of zinc chloride solution thus drawn in is 0.33 pound per cubic foot for sawed ties, and 0.3 to 0.5 pound per cubic foot for hewed ties. A chloride solution of 1.5 per cent. up to 4 per cent. in some cases is used and with it is mixed gelatin or glue, which eventually is to seal the cells of the wood. As the zinc chloride solution will also hold the gelatin in solution, the two are applied together. The chloride solution is then drained off and a tannin solution of about 0.5 per cent. strength

is admitted. This is applied under a pressure of 100 pounds for about one and a half hours. The insoluble combination of the tannin and the gelatin which forms is depended upon to seal the pores and hold the zinc chloride in the wood.

S. P. SADTLER.

The Smokeless Calorific Furnace. *Eng. and Min. J.*, November 22, 1902.—This is a furnace intended to be used with pulverized coal, and which can also be applied to the combustion of lignite and low-grade fuels. The coal to be used is first pulverized in a machine which reduces it to a fine dust, when it is conveyed to the feeding machine in front of the boilers for use in the furnace by a system of conveyors. The furnace consists of a combustion chamber having passages to supply the needed oxygen. The air is supplied by a small blower which also forces the coal from the feeder through the blast-pipe into the furnace. The feeding machine consists of a small worm, and is provided with a feed wheel. In this way, the fine coal is sprayed as it passes before the blast nozzle, thus obtaining a perfect admixture of the air and coal which pass into the combustion chamber from the blast nozzle in the form of a cloud of coal dust, which is met by currents of hot air from the air passages in the combustion arch and instantly ignites, burning with an intense heat. The advantages claimed for this apparatus are that the supply of air and coal is entirely under the control of the operator, as it can be instantly adjusted to feed greater or less quantities. The system is automatic, no handling being required after the fuel passes into the pulverizer. Complete absence of smoke, the saving of labor, and the complete combustion of the fuel are also claimed.

S. P. SADTLER.

Oil Fuel on the Pacific. *Sci. Amer.*, November 29, 1902.—The American Hawaiian Line, which operates a freight line of steamers between New York, San Francisco and Honolulu, is one of the first freight lines to adopt oil as fuel. The "Nevadan," of 6,500 tons, has thus far made three round trips between San Francisco and Honolulu, using oil as fuel. The distance covered was 12,500 miles. In the last trip the results were better than expected. The boiler and engines were worked to their full capacity, and not a burner was stopped throughout the trip. The steam was kept at 200 pounds, with no variation of more than a pound or two. Ordinarily there was not the least sign of smoke from the stack. The horse-power developed was 2,500, and only 1.22 pounds of oil were used per indicated horse-power. The consumption was 3,000 pounds or 9.25 barrels of oil an hour. The time of the trip was seven days and three hours, and the average hourly speed was 12.3 knots. Running with coal the ship would have made 1 knot less speed. The advantages of oil over coal as indicated in these tests are that 20 per cent. more power can be developed

from the same boilers. Not only this but the pressure is maintained uniformly at the same point. There is a reduction in the cost of labor in the fire-room, and coal-passers are no longer needed. Tests of running at different speeds have shown that it is apparently more economical to use the maximum power of the boilers and engines. It is found, moreover, from this experience that a pound of oil will evaporate from 14 to 15 pounds of water while a pound of coal will evaporate only from 9 to 9.25 pounds.

S. P. SADTLER.

The Specific Heat of Glycerin Waste Lyes and Crude Glycerin. BY A. H. GILL AND S. B. MILLER. *J. Soc. Chem. Ind.*, **21**, 833.—The object of this work was to obtain data for the proportioning of the heating surface of evaporators used in the recovery of glycerin from waste soap lyes. The lye or glycerin was heated in a platinum bottle to 100°, and transferred to a calorimeter, the rise of temperature of the water noted, from which observations the specific heat could be determined. The temperature range was from 25°–101°. The results are shown in the following table:

Sample.	Specific gravity.	Salt. Per cent.	Na_2SO_4. Per cent.	Glycerin. Per cent.	Specific heat.
A	1.126	11.1	2.3	6.2	0.8233
B	1.163	12.5	..	8.0	0.7841
C	1.206	16.4	4.2	8.1	0.7488
D	1.243	18.9	2.9	16.4	0.7313
E	1.294	9.4	0.4	55.5	0.6039
F	1.330	5.4	trace	87.0	0.4969

The various samples are as follows: A, Purified lye from the filter-press ready to be evaporated; B, from the clear lye tank partly evaporated; C, lye as it leaves the first evaporator; D, lye as it leaves the second evaporator; E, half-crude glycerin; F, crude glycerin.

A. H. GILL.

The Heating Effect of Gas. BY W. R. CRANE. *Mines and Minerals*, October, 1902.—Description of apparatus and method devised by the writer. The general arrangement resembles Hempel's apparatus, the method of burning the gas being quite different. The details are too numerous to be abstracted; any one interested is referred to the paper. No new determinations of calorific power are given.

J. W. RICHARDS.

Production of Natural Gas in 1901. *Iron Age*, September 11, 1902. (From report of F. H. Oliphant in "Mineral Resources of the United States.") The amount used was approximately 162, 172,000,000 cubic feet, valued at $27,067,500, or about 15 cents per 1000 cubic feet. This is an increase of $3,368,826 in value over 1900. The consumption has increased, but the pressure at which it is obtained has diminished, necessitating in many cases artificial compression to send it to market. The number of iron and steel works using this gas increased from 83 in 1900 to 102 in

1901, most of them being in Pennsylvania; besides these, 219 glass works and 5,421 miscellaneous industrial plants employ it as fuel.
J. W. RICHARDS.

Suppression of Smoke in Burning Bituminous Coal. By A. A. CARY. *Iron Age*, October 2, 9, 16, 23, 30, 1902.—A long treatise, very complete, and discussing at length the principles of combustion, cause of smoke, methods of preventing it, and appliances useful thereto. Well written articles, well worth reading.
J. W. RICHARDS.

The Chemical Treatment of Water. BY J. C. W. GRETH. *Iron Age*, October 9, 1902.—A review of the purification of water for industrial purposes, discussing the principal impurities, their harmful influence, the best method of eliminating them, and describing in detail a large purifying plant at the Lucy Furnaces, Pittsburg.
J. W. RICHARDS.

Oil Fuel for the Navy. *Iron Age*, October 30, 1902.—Contains the preliminary findings of the special board which has been testing the efficiency of oil-firing. The information is very detailed, giving the analyses of the oil, its cost, conditions for combustion, and tests made. The thermal efficiency is not increased by using steam for atomizing, as many erroneously suppose. The conclusions so far reached are that oil can be burned very uniformly; the evaporative efficiency of nearly all kinds of fuel oil is alike; a marine steam generator can be forced to as high a degree with oil as with coal; that so far no ill effects are shown on the boiler; that firemen favor using it; the air for combustion should be preheated, if possible; the oil should be heated; when using heavy forced draft, it is not possible to prevent some smoke; compressed air for atomizing enables a greater forcing of the boiler than when using steam.
J. W. RICHARDS.

The Borax Deposits of Death Valley and Mohave Desert. BY M. R. CAMPBELL. *Eng. Min. J.*, October 18, 1902. (From Rep. of U. S. Geol. Survey.)—In 1890 it was found that the borax crust on marshes is a secondary deposit from beds of borate of lime (colemanite), and since then the marshes have been abandoned and mines established on the bedded deposits. The Pacific Coast Borax Co's mine at Borate, 12 miles northeast of Daggett, Cal., is the chief producer of borax and boracic acid in this country. The beds are in lake sediments of tertiary age; they extend for a mile and a half, varying in thickness from 6 to 10 feet. The recent geological history of this region is exceedingly complex, and more work is needed before the origin of the borax and associated minerals can be fully determined.
J. W. RICHARDS.

White Arsenic Production. By J. W. Wells. *Rep. Ontario Bureau Mines*, 1902.—Describes the treatment of siliceous mispickel at the Dolores Mine, Ontario, which in 1901 produced 1,389,056 pounds. It is crushed and amalgamated, whereby 57 per cent. of its gold content is obtained. The tailings are concentrated, and 90 per cent. of their gold content extracted by the Sulman-Teed bromo-cyanide process. The residues are roasted in two Oxland furnaces, placed tandem, the fumes being caught in brick settlers. The crude arsenic oxide is dropped into cars beneath the settlers, and refined in a reverberatory furnace fired with hard wood, with a hearth 16 by 24 feet, the fumes being drawn through a dust chamber 100 feet long and then through 12 zigzag chambers. The product is 99.6 per cent. pure. In the United States, the Puget Sound Reduction Co. made 300 tons in 1901. J. W. Richards.

AGRICULTURAL CHEMISTRY.

Field Operations of the Bureau of Soils, 1901 (Third Report). By Milton Whitney, et al. *U. S. Dept. Agr.*, 1902, 647 pp. —This contains a general review of the soil survey work during the three years that it has been in progress, by the chief of the bureau, and detailed reports upon the areas under investigation during 1901 by the following assistants in charge of field parties: T. H. Means, C. W. Dorsey, J. A. Bonsteel, W. G. Smith, G. N. Coffey, C. N. Mooney, E. O. Fippin, J. O. Martin, C. A. Jensen, M. H. Lapham, J. G. Holmes, R. T. A. Burke, J. E. Lapham, W. H. Heileman, and H. W. Marean. The report is illustrated by 96 plates and 25 text figures and is accompanied by a portfolio case containing 31 maps.

Up to the present time surveys of areas in 21 states and territories have been reported, the total area amounting to 15,871 square miles. The soils met with have been grouped into 17 general classes as follows: Stony loam, gravel, gravelly loam, dunesand, sandhill, sand, fine sand, sandy loam, fine sandy loam, loam, shale loam, silt loam, clay loam, clay, adobe, meadow, and muck and swamp. These represent 180 or more types as recognized by the bureau. Some tentative conclusions are drawn as to the adaptability of different classes of soil to various crops. For instance, in the areas so far surveyed 9 per cent. of the stony loam, 24 per cent. of the sand, 55 per cent. of the fine sand, 12 per cent. of the sandy loam, 2 per cent. of the fine sandy loam, and 2 per cent. of the loam have been found adapted to the growth of peaches, and this crop has not been reported as important on any of the other classes of soil.

During 1901, districts located in California, Georgia, Idaho, Louisiana, Maryland, Michigan, Mississippi, New Jersey, New

York, North Carolina, Pennsylvania, Tennessee, Texas, Virginia, and Washington, and having an aggregate area of 10,246 square miles, were surveyed and mapped at a total cost of $3.50 per square mile. The report upon each area deals with the location and boundaries, history of settlement and agricultural development, climate, physiography, geology, types of soil, agricultural methods in use, and agricultural conditions. In different areas other features, such as hardpan, water supply for irrigation, underground and seepage waters, drainage, and reclamation of soils, have been considered. In the western areas, alkali problems have received special attention. In the 24 papers contained in this volume are reported mechanical analyses of 692 samples of soils and chemical analyses of 8 samples of soils, 70 of alkali salts, and 34 of waters. H. W. LAWSON.

Phosphates. BY H. J. PATTERSON. *Pa. Dept. Agr. Bull. No. 94*, 87 pp.—This is a rather full discussion of the different sources and forms of phosphoric acid used in agriculture and their methods of preparation and application. The bulletin includes the results of experiments conducted by the author at the Maryland Experiment Station. The author considers that much of the practice now followed in the use of phosphates is not founded upon facts. Soils should be kept well supplied with organic matter in order to secure a full utilization of phosphates by plants. Some crops have a much greater ability than others to use crude or insoluble phosphates. The availability of phosphates is increased by the presence of lime. Iron and alumina phosphates have a much greater fertilizing value than is generally considered. The value of available phosphoric acid in fertilizers is not dependent upon its source. Certain classes of phosphates have a greater availability than is shown by official methods of analysis. H. W. LAWSON.

The Value of Barnyard Manure. BY C. E. THORNE AND J. F. HICKMAN. *Ohio Agr. Expt. Sta. Bull. No. 134*, pp. 89–101.—Several experiments are reported from which it is concluded that it will pay well to give more attention than is ordinarily done to the preservation of barnyard manure. The loss of ammonia may be reduced by treating the manure with kainit or gypsum. This same purpose may probably be accomplished as effectively by acid phosphate or the untreated rock, which materials have the advantage over gypsum or kainit of adding the constituent most deficient in the manure. While acid phosphate gives the best results it is thought that the finely ground rock, if mixed early with the manure, may prove an economical substitute.

H. W. LAWSON.

The River Irrigating Waters of Arizona—Their Character and Effects. BY R. H. FORBES. *Ariz. Agr. Expt. Sta. Bull. No. 44*, pp. 147–214.—A systematic study begun in 1899, of the waters of the Salt, Gila, and Colorado Rivers is reported, together with analyses of a number of samples from other sources. Determinations were made of the amount and fertilizing value of the silts and the amount and character of the soluble salts. Great variations were observed in the quality of the water for irrigation purposes, the silt and salt content depending upon a number of conditions, such as the nature and condition of the watershed and the amount and location of the rainfall. Mention is made of flooding and drainage for the removal of alkali salts and of deep irrigation followed by thorough cultivation for lessening the accumulation of alkali at the surface where salty irrigation waters are used. H. W. LAWSON.

A Soil Study. IV. Ground Water. BY W. P. HEADDEN. *Colo. Agr. Expt. Sta. Bull. No 72*, 47 pp.—Previous parts of this study deal with the growth and composition of sugar-beets as affected by alkali and the composition and physical condition of the soil as affected by the culture of the crop. The present bulletin reports a study of the ground water with special reference to soluble salts. Numerous analyses are given and many points are emphasized in the discussion. Changes in the water plane not due to rainfall or irrigation were observed and attributed to atmospheric conditions. Chlorides and nitrates in the ground water bore no definite relation to the total solids. It was hoped that the determinations of chlorine might throw some light upon the movement of alkali salts in the soil, but no general deductions were considered as justified by the results. The solids in the ground water differed in composition from the alkali incrustation from the same soil. The ground water also differed from the drain water and from the solution obtained by exhausting the soil with distilled water. The upper portions of the ground water contained more solids than deeper portions and the salts varied in their relative quantities. No general conclusions are drawn from the study as a whole. H. W. LAWSON.

The Influence of Preservatives upon the Food Value of Milk. BY C. F. DOANE AND T. M. PRICE. *Md. Agr. Expt. Sta. Bull. No. 86*, pp. 15–64.—This bulletin discusses the use and effect of preservatives in food, especially in milk, the literature of the subject being reviewed, and experimental work at the station covering a period of two years being reported. The experiments at the station were conducted with calves and were designed to determine the digestibility of milk preserved with boric acid (1 : 1,000), borax (1 : 675), salicylic acid (1 : 1,000), and formal-

dehyde (1 : 10,000). As would appear from the results, boric acid, borax, and salicylic acid lessened the digestibility of the milk, which fact is considered sufficient to condemn them. The effect of salicylic acid was most marked, the difference in the digestibility of preserved and unpreserved milk being 3.48 per cent. of protein, and 4.56 per cent. of fat. Milk preserved with formaldehyde, on the other hand, was more digestible, the difference being 1.31 per cent. of protein and 0.99 per cent. of fat. In view of the varying results that have been obtained, the authors find it difficult to draw definite conclusions in regard to the use of preservatives. They consider, however, that until more definite knowledge to the contrary is obtained, the safest course to pursue is to discourage the use of preservatives in milk in every way possible. H. W. LAWSON.

Manufacture of Table Syrup from Sugar-Cane. BY H. W. WILEY. *U. S. Dept. Agr., Bureau of Chem., Bull. No. 70*, 32 pp.—An account of this industry in the south is based upon personal inspection by the author in Georgia. Notes are given on a large number of samples of soils, together with chemical and mechanical analyses. The soils represented were almost pure sand and showed a deficiency in potash soluble in hot hydrochloric acid, and to a less extent a deficiency in phosphoric acid. Analyses of numerous samples of sugar-cane are also reported which show a high average percentage of sucrose and usually a low quantity of reducing sugar. Some of the problems needing further study are the character and adulteration of the syrups now on the market, the use of fertilizers in the culture of sugar-cane, the improvement of milling processes, the methods of clarifying and purifying the juice previous to its evaporation, and the production of a syrup of uniform character and its handling to prevent fermentation. H. W. LAWSON.

Foods and Food Control. BY W. D. BIGELOW. *U. S. Dept. Agr., Bureau of Chem., Bull. No. 69, Parts I–V*, 461 pp.—This is a compilation of the federal and state food laws now in force. H. W. LAWSON.

PATENTS.

JUNE 24, 1902.

703,219. Claus A. Spreckels and Charles A. Kern, N. Y. **Intermediate sugar product.** A mass of sugar crystals mixed with a sulpho-oleaginous body.

703,240. Eugene R. Edson, Cleveland, Ohio. **Gelatine yieldable liquid.** Heats the material containing gelatine and passes

an extracting liquid as water through it while heated sufficiently to prevent fermentation.

703,241–2–3. Arthur Eichengrun and Theodor Becker, Elberfeld, Germany. Assignors to Farbenfabriken of Elberfeld Co., New York, N. Y. **Photographic developer.** Reacts with pyrogallol on dimethylamine, and isolates a crystalline compound soluble in water, having an alkaline reaction, melting at 163° C., difficultly soluble in alcohol, insoluble in ether, and adapted to form a developer when dissolved in water with sodium sulphite. 703,243 relates to making the pyrogallol-dimethylamine.

703,289. Hugh K. Moore, Lynn, Mass. Assignor to Moore Electrolytic Co., Boston, Mass. **Producing caustic.** Electrolyzes alkaline sulphates or chlorides by bringing an aqueous solution in contact with one face of a porous diaphragm, the other face being in contact with an unsubmerged foraminous cathode, converting the metal ion into a hydroxide, continuing the electrolysis in the pores of the cathode and confining the hydrogen in contact with the cathode in place of air.

703,295. Rodman B. Newport, Philadelphia, Pa. **Treating garbage.** Digests the same to melt and free the grease, presses out the grease and other liquid matters, mixes the pressed mass with phosphates and sulphuric acid, in quantities sufficient to decompose the solid matters by the heat developed by the reaction, and in the absence of external heat.

703,319. Theodor W. Tallquist, Borga, Russia. **Haemoglobinometer.** A scale of colors (red) of varying depth to correspond with the percentage of haemoglobin in the blood and a receiver of white filter-paper for the blood to be compared.

703,341. Abraham B. Glass, Vienna, Austria-Hungary. Assignor to Julius Back, same place. **Impregnating paper.** A mixture of calcium hydroxide 20, dextrin 80, and flour or starch 40, with water sufficient to obtain the consistency desired.

JULY 1, 1902.

703,512. Richard Szigmondy, Jena, Germany. **Composition for ruby glass.** Barium nitrate and sodium oxide, in small quantities with from 0.25 to 1.7 parts of gold to each 10,000 parts of quartz sand.

703,516. McKenzie Arnn, Bristol, Va. **Mineral compound.** Adds 20 per cent. of the following mixture to ordinary cement. Molten slag is treated with a mixture of sulphuric acid 70, and hydrochloric acid 12, salt 600, lime 250, mica, talc, and kaolin 10 each. The mixture is cooled and pulverized, and to each 100 pounds is added sulphuric acid 1, coal tar 5 pounds, and 5 ounces of hydrochloric acid.

703,543. Eben B. Clarke, Pittsburg, Pa. Assignor to Firth Stirling Steel Co. Making **crucible steel.** Mixes the usual materials in required predetermined proportions, melts and introduces into a previously heated crucible covered to prevent oxidation, and heated till the reaction is finished.

703,640. George P. Chappell, New York, N. Y. Making **artificial stone.** Mixes magnesium oxide 2, and chloride and water 1 part each, then works to a putty with a filling material and molds.

703,692. Conrad R. Boehm, Charlottenburg, Germany. **Carbons for arc lamps.** Adds an equivalent of magnesium fluoride to the carbon before adding the tar or other binding material.

703,696. Clemens Dorr, Cologne, Germany. **Utilizing colliery waste.** Granulates carboniferous waste and adds thereto coal slime, coal dust, small coal, etc.

703,814. Ludwig v. Ordodny, Budapest, Austria-Hungary. Obtaining **fibers from plants.** Macerates reeds rushes, etc., in hot water, cuts in strips, boils in 2 to 3 per cent. potash or soda with an emulsion of petroleum and calcium hydroxide, then separates the fibers and purifies them in vinegar.

703,857. Constantin J. Tossizza, Paris, France. **Electrolysis of zinc blende.** Also nickel, cadmium, etc. The voltage is lowered by the use of sulphurous acid as a depolarizer, the process being in two parts, the first consisting in the electrolysis of the metallic salt with a copper anode and formation of the copper salt and subsequent reconstitution of the copper anode by decomposition of the copper salt in a solution charged with sulphurous acid.

703,863. Richard Volker, Budapest, Austria-Hungary. **Embossed wall covering.** Consists of a woven backing and a plastic coating of magnesite 20, asbestos 10, gypsum 30, dextrin and magnesium chloride 20 each.

705,139. Frederick Priestman, Burlington, Iowa. **Paint remover.** Kerosene 1 quart, aqua ammonia and fusel oil each 1 pint, sal soda 20 pounds, and hot water 5 gallons.

705,152. Harry W. Smith, Sutton Coldfield, William T. Gidden, Langley Green, near Birmingham, and Alfred G. Salamon, London, England. Assignors to the British Cyanides Co. Limited, Oldbury, England. Making **sulphocyanides from coal gas.** Coal gas containing ammonia and cyanide compounds is repeatedly scrubbed with water in scrubbers containing sulphur, a large amount of water being used in the last scrubbing to absorb ammonia, drawing off strong ammonium sulphocyanide from the first scrubber and moving the contents of the other scrubbers forward one vessel and filling the last scrubber with water.

705,168. John W. Warren, Omaha, Neb. **Purifying hydro-**

carbon oils. Treats them with a solution of sugar of lead, then adds clay of Wyoming formation, draws off the distillate, adds sulphuric acid, neutralizes this with more clay, draws off the distillate, adds caustic potash, allows it to stand, adds more clay, and when clear draws off.

705,213. Oscar Daube, New York, N. Y. **Carbonizing organic materials.** Mixes two-thirds air under 5 to 8 pounds pressure, with one-third nitrogenous gas from organic material, etc., passes the mixture through a coal fire, the temperature on leaving the fire being from 400° to 600° F., treating wood to be carbonized by said gas at the initial pressure, exhausting the gas liberated from said material, and condensing the by-products, *viz.*, acetic acid, etc.

705,216. John T. Davis, San Francisco. **Artificial fuel.** Carboniferous material 1000 parts, pitch 100, and carbon dioxide 30 parts.

705,244. Albert J. Hill, Twickenham, England. **Cellulose fabrics.** The process of applying a solution of cellulose to the fibers of a hydrated cellulose fabric, precipitating the cellulose, washing out the solvent and coating the fibers with a proteid, as albumen in solution.

705,253. Arthur E. Krause, Jersey City, N. J. **Removing oil from water.** A magnesium compound like serpentine insoluble in water is mixed with the oil and water, and it gathers the oil to itself and is removed with the oil.

705,264. James Mactear, Westminister, England. **Electrolytic apparatus for chlorine and alkali.** A cathode plate arranged near the wall of its cell and provided with a recess on the upper face, a centrally arranged well and series of ducts on its lower face, an anode cell engaging in said recess, a supply and overflow pipe for the anode cell, a propeller in said well, the spindle extending through the anode cell, and suitable anodes and cathodes.

703,875. Walter E. Winship, San Francisco, Cal. Making **storage battery material.** Mixes an oxide of lead with a glycerin solution and reduces by electrolysis in an alkaline bath in which the lead salt is soluble, and from which solution lead trees essentially parallel to each other are plated out within the mass.

703,930. Bruno Jansen, Meiningen, Germany. Making **rotary cutters.** (Aluminum steel.) Melts a charge of iron and steel containing an excess of the required per cent. of carbon, puddles with vigorous stirring to oxidize the excess of carbon which raises the temperature, adds aluminum, and casts.

703,940. Hermann A. E. Menne, Creuzthal, Westphalia, Germany. Assignor to Coln Musener Bergwerks Actien Verein, same place. **Fusing metals.** Slag in furnaces is removed by an oxyhydrogen or similar jet with excess of oxygen under such pressure as to force the metal melted out of the pit made by the jet.

JULY 8, 1902.

704,013. John A. Emig and John G. Krout, York, Pa. **Insecticide.** Turpentine 72 per cent., kerosene 25 per cent., and English red 3 per cent., used on grain to prevent the Hessian fly.

704,027. Henri Gouthiere, Paris, France. Assignor to Gustave E. Junius, London, England. **Purifying sugar juice.** Treats it with a concentrated solution of ferric fluoride and adds milk of lime to make calcium fluoride and ferric hydroxide, then precipitates the iron as a phosphate.

704,036. Carl Hoepfner, Frankfort-on-Main, Germany. **Separating alkali metal sulphates in solutions.** Cools the solutions rapidly by flowing them into a solution of a suitable chloride below 0° C., with constant stirring, and using the cold solution to cool gases in a refrigerating plant by which the chloride solution is cooled.

704,066. Mark W. Marsden, Philadelphia, Pa. **Building materials.** Coats fibrous sheets with sodium silicate and magnesium sulphate, and arranges them for the reception of plaster.

704,082. Harry C. McKay, Essington, Pa. Assignor to American Patent Kid Co., of N. J. **Patent leather varnish.** Boiled linseed oil and amyl acetate equal parts, guncotton in amyl acetate 1 to 2 parts, and coloring-matter as nigrosin in methyl alcohol. The first two solutions are mixed in the proportions of 1 to 4.

704,259. Enoch T. Holmes, Chicago, Ill. Assignor one-third to John C. Brocklebank, same place. Process of **treating fibrous substances.** Boils flax straw in alkaline solution of 6° to 7° Bé. 100 pounds to 50 gallons at 80 to 100 pounds pressure for from four to six hours.

704,272. Van Vechten, W. Riesberg, Philadelphia, Pa. Apparatus for making **carbon dioxide.** A gasometer telescoping vertically, with a hollow central vertical shaft adapted to revolve and with a stirrer at its lower end, and an acid supply pipe to deliver acid on the material in the bottom of the gasometer.

704,285. Thomas V. Allis, Bridgeport, Conn. Assignor to the International Tin Plate Corporation. **Compound to separate sheets in packs.** Powdered asbestos 12, an adhesive as glue 1, and water 16 parts. Used to prevent adhesion of metal sheets when heated.

704,301. Charles de la Harpe, Basle, Switzerland. Assignor to Dye Works formerly Durand, Huguenin, Co. **Leucogallocyanin.** A sulphonic gallocyanin, derived from a nitrosoethylbenzylanilinsulphonic acid, is treated with a reducing agent, the dye being soluble in hot water yellowish green, in sodium acetate pale blue, in sulphuric acid reddish turning blue by oxidation, and dyeing on chrome mordants blue shades.

704,349. Eugene Leconte, Estaires, and Jerome Loiselet, Paris, France. Making **rice starch.** Washes the starchy substance with successive alkaline solutions of decreasing strength, mills the same, and finally subjects the mass to an alternating electric current while in an alkaline solution.

704,393. Albert Simon, Bordeaux, France. Making **iron, manganese, and alloys** thereof by electricity. Adds carbon to the material to be treated, also calcium fluoride sufficient to dissolve the material, and then subjects the mass to the action of a continuous electric current to produce decomposition and keep the mass in a fluid condition.

704,409. Henry E. Way, Custer, S. D. Assignor one-half to Harry B. Griffith, same place. **Ore-testing tablet.** Made of charcoal, 16 parts, and potassium nitrate, 27 parts by weight.

704,490. Jean J. A. Trillat, Paris, France. Assignor to Fries Bros., New York, N. Y. Composition for producing **formaldehyde vapors.** Formic aldehyde is mixed with a soluble chloride as sodium or calcium chloride.

JULY 15, 1902.

704,595. Charles B. Thwing, Galesburg, Ill. Assignor to Louis S. Langville, New York, N. Y. **Thermoelectric element.** Iron is the positive element, and an alloy of copper and nickel of the composition Ni_3Cu_2, the negative.

704,628. Emil Gathman, Washington, D. C. Assignor to George W. McMullen, Pictou, Canada. **Drying nitro-compounds.** Heats the compound in a sealed vessel till perfectly dry.

704,639. Carl Hoepfner, Frankfort-on-Main, Germany. **Extracting ores.** Ores containing copper, lead, and silver are leached with a cuprous chloride solution having less solvent than will saturate the ore, precipitating the lead and silver, reconstituting the cupric chloride solution and applying the same at a higher temperature, thereby dissolving copper, precipitating iron by an oxygen salt of copper, electrolyzing the copper solution and returning the solvent into the cycle of operations.

704,640-1. To same parties for a **similar process.** The three patents are issued to Henry Orth, Jr., as administrator, Washington, D. C., the second relative to copper and nickel, the third to zinc, etc.

704,662. Heinrich Oppermann, Berlin, Germany. **Oxidized milk albumen.** Mixes casein with water, adds magnesium peroxide and glycerin. Used as a preservative coating.

704,675. David H. Browne, Cleveland, Ohio, and James M. Neil, Toronto, Canada. **Recovering tin.** Treats scrap tin with a heated acid solution of ferric chloride, and precipitates the tin by electrolysis.

704,717. Bertrand M. Thomas, San Francisco, Cal. **Artificial fuel.** Mixes tule peat with crude petroleum, then with alkaline earth and molds.

704,758. William C. Riley, San Francisco, Cal. **Sterilizing and preserving cocaine.** Places dry cocaine in a receptacle and plugs the mouth with dry sterilized cotton, heats the whole to 145° C., removes the cotton plug and seals hermetically.

704,798. Christoph Hartmann, Hochst-on-Main, Germany. Assignor to Farbwerke vorm. Meister, Lucius und Brüning, same place. **Blue anthraquinone dye.** Treats specific anthraquinones with formaldehyde and sulphurous acid; the dyes are dark blue powders, soluble in water pale blue, in strong sulphuric acid blue; the water solution does not change on adding dilute acids or alkalies.

704,804. Bruno Homolka and Otto Liebknecht, Frankfort-on-Main, Germany. Assignors to Farbwerke vorm. Meister Lucius und Brüning, same place. Process of making **indoxyl.** Sodium amide is caused to react in the presence of diluents on phenylglycinphenylglycin, at a high temperature.

704,825-6. Both to Wilhelm Herzberg and Otto Siebert, Berlin, Germany. Assignors to Aktien Gesellschaft für Anilin Fabrikation, same place. **Red azo dyes.** Diazotized paranitroorthoaminosalicylic acid is combined with orthoaminoparatolueneparasulphamino toluene, forming a reddish brown powder with metallic luster, readily soluble in warm water and turning deep red on adding soda-lye, but orange-red with hydrochloric acid, dyeing chromium mordanted wool fast yellowish red shades.

704,831. Charles B. Jacobs, East Orange, N. J. Assignor to Ampére Electrochemical Co., Jersey City, N. J. Making **sulphuric acid** from sulphur dioxide in aqueous solution by electrolysis. Sulphur dioxide is supplied to the anode of an aqueous electrolytic bath and the current is passed upwards to oxidize the sulphur dioxide in the lower part of the bath and retain the product of oxidation remote from the cathode.

704,843. Roberto Lepetit and Ernesto Tagliano, Susa, Italy. Making **extract dyes.** Treats a natural dyewood extract with a sulphurous acid salt of an alkali metal at 110° C. to 150° C. under pressure.

704,849. James T. McKim, Thorntown, Ind. Assignor one-half to Lewis Miller, same place. **Cement.** Ten parts of the following compounds are mixed with 70 parts each of sharp sand and Portland cement. Calcareous ochre and iron ore paint, each 49, and litharge ground and heated to 160° F., 2 parts.

704,939. Carlo Sella, Bielia, Italy. Process of making **composition for oiling fiber.** Dissolves castor oil soda soap in oleïn, stirs in water and glycerin and then water alone.

704,959. George W. Doore, Dover, Me., and Allan J. Doore, Greene, Iowa, the latter assignor to the first. **Paint.** Mixes coal tar 52, and gasoline 10 gallons, with cement 10; graphite 5, sodium chloride 5, and sodium carbonate 2.5 pounds.

704,989. Lafayette D. Vorce, Chicago, Ill. **Extracting oil.** Subjects oil-bearing material in a closed chamber to a volatile solvent, removing the solution and steaming the exhausted material to remove residual solvent, conducting the mixture of vapors into closed pipes over which the solution first made is caused to flow in thin layers and thereby removing most of the solvent and completing the separation by heat from another source.

JULY 22, 1902.

705,034. Daniel Cameron, Kansas City, Mo. Assignor to Cudahy Packing Co., Chicago, Ill. **Extracting grease.** Passes hot grease-carrying substances through a grinder, then into a closed vessel, where they are heated and stirred without water, the grease rising, which is removed, while the residue is dried.

705,109. George Mitchell, Maco, Arizona. **Reducing copper matte.** The matte is blown in a converter to copper with a small percentage of suboxide, two or more converter charges are put in a reverberatory furnace and another converter charge blown to a predetermined condition to make the mixture contain a proper amount of suboxide, and the whole is poled.

705,330. Charles T. Dudley, Golden, Col. Assignor one-fourth to Wm. W. Dudley, Frank L. Browne, and Wm. T. Norton, Washington, D. C. Treatment of **steel ingots.** The ingot of cast steel is cooled to 550° C., then reheated to between 750° and 850° C. for from thirty to forty-five hours, finally heated to forging temperature.

705,418. Hermann A. E. Menne, Creuzthal, Germany. Assignor to Coln-Musener Bergwerke Actien Verein, same place, **Burner for removing hard slag from furnaces.** See patent 703,940 for method. A burner with concentric pipes for carrying fuel and oxygen, means for centering the inner pipe in the outer pipe, a circular layer of yielding material surrounding the delivery end of the outer pipe, and a circular covering of hard refractory, non-conducting material surrounding said yielding material.

705,456. Duncan Sinclair, Coalbrookdale, England. **Iridescent coating** of copper, bronze, etc. Cleans a surface of copper or its alloys, and immerses it in an electrolyte of water 60, lead oxide 10, alkali 14, and copper salt 0.5 part solution, and during the deposition of metal covers a part of the surface by a resist varnish whereby the depth of coating and consequently the color is varied.

705,462. George H. Smith, New York, N. Y. **Fertilizer.**

Mixes night soil 32, calcium carbonate 8, alumina silicate 6, and phenol 4, air-dries and grinds.

705,542. Milton T. J. Ochs, Allentown, Pa. **Plaster composition.** Aluminum silicate and calcium carbonate 1 part each, hydraulic cement 2 parts.

705,545. Watson Smith, London, England. Assignor to firm of E. Merck, Darmstadt, Germany. **Cineol arsenate.** A white crystalline solid, melting at 95° C., soluble in alcohol and ether, decomposing on contact with water into its components. Cineol may be obtained by treating a compound thereof, as eucalyptus oil with arsenic, whereby cineol arsenate is formed, then splitting up this compound with water.

JULY 29, 1902.

705,570. Fritz A. Feldkamp, Newark, N. J. Apparatus for making **carbon dioxide.** Three concentric cylinders, the inner one perforated and suspended on a sliding tube also adapted to hold a carbonate, the middle cylinder bottomless for a gasometer, the outer one with a domed top and delivery tube, and half filled with water, also with pressure gauge.

705,589. Alfred James, London, England. Apparatus for **precipitating gold and silver.** A series of iron vessels arranged on steps, and each cast in one piece, having a partition near the bottom, the liquid flowing down the side of the vessel under the partition up through the material and by a spout to the next vessel.

705,625. Wm. A. Tucker, Terre Haute, Ind. Assignor one-half to Wm. R. Adams, Clarkshill, Ind. **Moisture-proof coating** for brick or stone. Consists of beeswax 1, paraffin 3, Venice turpentine 3, glue 1, linseed oil 1, and coal oil, 3 parts.

705,638. Ferdinand Blum, Frankfort-on-Main, Germany. Assignor to firm of E. Merck, Darmstadt, Hessen, Germany. **Glycosuria antidote.** The juice of suprarenal glands is injected into an animal, the blood withdrawn in due time, and the serum separated, which is said to constitute a new substance.

705,643. Otto Buss, Ruschlikon, Switzerland. **Casein photographic film.** Dissolves casein in an organic acid, adds glycerol, coats a suitable support therewith, renders the casein insoluble by a haloid salt free from silver, and then sensitizes the coating.

705,650. Valentin Conti, George de Geoffroy, and Georges Le Gall du Tertre, Paris, France. **Artificial stone.** Aluminum sulphate and pulverized kieselguhr each 15, magnesium sulphate 75, magnesium chloride 25, calcined magnesia 50, and inert matter, as pulverized stone, cork, or sawdust, to give required density.

705,667. Robert Groppler, Berlin, Germany. **Solidifying formaldehyde.** Gently heats small quantities of sodium soap with an aqueous solution of formaldehyde.

705,687. Albert Mackensen, Dusseldorf, Germany. Making **vegetable parchment.** Dissolves boracic acid in boiling glycerol, cools the mixture to a wax-like mass, dissolves said mass in glycerol and draws the parchment through it.

705,691. Wm. J. Morton, New York, N. Y. **Separating the volatile constituent** of a composite fluid, by delivering a thin stream thereof into the path of a convective action of high-tension electricity, as between the poles of a static machine.

705,712. Herman B. Schmidt, Cincinnati, Ohio, and Omar T. Joslin, New York, N. Y. Apparatus for **refining glycerin.** A still in which the vapor of glycerin is mingled with superheated steam, coils for heating the medium and superheating the steam which passes into the still, a separator to separate the vapors of glycerin and steam, and the pipe connecting the vapor chamber of the still with the lower part of the separator.

705,723. Gustav Tuschel, Odessa, Russia. **Process of varnishing.** Heats the material and applies a coat of white lead 1000, water 1500, yellow aniline 1 or 2, and stick Russian glue 125 parts.

705,727. Frederick C. Weber, Chicago, Ill. Making **alloys of aluminum,** etc. Places a charge of finely powdered oxide in the bottom of a crucible with a small coil of aluminum wire, another charge of oxide mixed with aluminum around an upper coil of aluminum wire, first drying the upper charge by electric current through the lower coil, then melting the lower coil and generating sufficient heat to propagate the reaction to the upper coil and charge, whereby the oxide is reduced or the alloy made.

705,748. Max Fremery and Johannes Urban, Oberbruch near Aachen, Germany. **Washing cellulose,** by allowing a small stream of dilute acid to flow on the material while coiled up, whereby metallic impurities are converted into soluble combinations and removed.

705,785. Cecil O. Phillips, New York, N. Y. Assignor to American Cotton Oil Co., same place. Process of producing **cottonseed oil.** Crushes the meats, warms them, neutralizes the free fatty acids therein by a slight excess of alkali, heats them to a higher temperature and expresses the oil.

705,803. Walter S. Wilkinson, Baltimore, Md., and Charles H. Burchinal, Pittsburg, Pa. **Asphalt pavement.** A paving block of crushed conglomerate rock carrying 0.5 to 1.5 per cent. of native copper, finely powdered, calcareous fines and an asphaltic cement.

705,904. Archibald D. Carmichael, Broken Hill, New South Wales, Australia. **Desulphurizing sulphur ores.** Mixes with the ore a sulphur compound of an alkaline earth metal, and heats the mixture to start the reaction, then passes a current of air to oxidize the sulphur compound of alkaline metal preparatory to starting a new charge.

705,938. Wm. Lennard Foote, Brooklyn, N. Y. **Paint.** Kaolin and corundum 2 each, talc 1, silex 3, zinc oxide 4, hydrofluoric acid 1.5, alum 0.5 part, and enough of a mixture of potassium and sodium silicate to make the paint of a proper consistency.

705,956. William C. Oberwalder, New York, N. Y. Composition for **cleaning, preserving, and polishing metals.** Abrasive material, as infusorial earth 7, sodium sulphate 2, borax 0.5, camphor 1, and soap 10 parts. WM. H. SEAMAN.

REVIEW OF AMERICAN CHEMICAL RESEARCH.

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WILLIAM A. NOYES, Editor.

GENERAL AND PHYSICAL CHEMISTRY.

The Optical Rotatory Power of Cane-Sugar when Dissolved in Amines. BY G. M. WILCOX. *J. Phys. Chem.*, 6, 339–342.—The author finds that cane-sugar has a much higher rotatory power in isopropylamine, allylamine and amylamine solutions than in aqueous solution. G. N. LEWIS.

The Expansion of a Gas into a Vacuum and the Kinetic Theory of Gases. BY PETER FIREMAN. *J. Phys. Chem.*, 6, 463–466.—The author discusses the changes in temperature of a gas escaping into a vacuum and concludes that the lack of uniformity in the molecular velocities is alone responsible for the temperature changes in question, the Joule-Thomson effect being negligible. Whether or not this conclusion is justifiable, the paper serves to call attention to a problem whose solution has been too frequently taken for granted in the development of the kinetic theory. G. N. LEWIS.

Deduction of the Magnitude of the Osmotic Pressure in Dilute Solutions According to the Kinetic Theory. BY PETER FIREMAN. *J. Phys. Chem.*, 6, 636–638.—An unsatisfactory attempt to explain osmotic pressure. The hypotheses are not clearly defined, nor are the processes of reasoning made apparent to the reader. G. N. LEWIS.

Limitations of the Mass Law. BY WILDER D. BANCROFT. *J. Phys. Chem.*, 6, 190–192.—The author points out that if, in equilibrium, the concentrations of the factors and products of a chemical reaction are known for the gaseous phase, it is not possible to calculate the extent of the reaction in a solution, even if each of the molecular species alone obeys Henry's law, for Henry's law may not apply to one of the species in the presence of the other. G. N. LEWIS.

A Derivation of the Phase Rule. BY J. E. TREVOR. *J. Phys. Chem.*, 6, 185–192.—This is a formal derivation of the phase rule, first for a system in which all the substances in the system are independent components, then for the general case. The proof is brief and appears to be rigorous. It introduces no new principle and differs from its numerous predecessors chiefly in form and nomenclature. G. N. LEWIS.

Alloys of Tin, Lead and Bismuth. BY E. S. SHEPHERD. *J. Phys. Chem.*, 6, 519–553.—When a molten alloy of lead, tin and bismuth is cooled there are three singular points in the temperature curve. This is the simplest case, indicating the separation of three solid phases and giving no evidence of metallic compounds. By the aid of a new analytical method, the three phases were proved to be pure tin and solid solutions of lead in bismuth and of bismuth in lead. The existence of these solutions is confirmed by the aid of the microscope and by etching. Bismuth is able to dissolve 5 per cent. of lead; lead to dissolve 4 per cent. of bismuth. The phenomenon of recalescence was studied and the author conjectures that it is due to the formation of a denser unstable modification of tin. This, however, would seem inconsistent with the author's statement that recalescence takes place at no fixed temperature, for the two phases of tin with the other two phases should make a non-variant system. The paper contains a discussion of earlier work and a bibliography.
G. N. LEWIS.

Crystallization from a Current-Bearing Electrolyte. BY PAUL R. HEYL. *Phys. Rev.*, 15, 335–344.—Careful measurements were made and discussed statistically to determine whether crystals have any different properties when separating from a solution during electrolysis. Copper sulphate and mercuric iodide were used. The results were negative. G. N. LEWIS.

The Spectra of Gases at High Temperatures. BY JOHN TROWBRIDGE. *Proc. Am. Phil. Soc.*, 41, 138–140.—The author summarizes his recent work on electric discharges through gases, carried on by means of his enormous storage battery, which is capable of giving a spark of two meters, at over six million volts. With varying conditions, striking variations in the spectra are obtained. Thus it is possible to show distinctly the two spectra of argon, even in tubes filled with purest hydrogen. The spectrum of water vapor is present in all cases and the author comes to the remarkable conclusion that a perfectly dry gas would be a perfect electrical insulator. "Just as a certain degree of moisture is necessary for chemical reactions, so is water vapor essential for the discharge of electricity through gases." The paper concludes with the mention of the occurrence of bright lines in the photographic negative of the spectra, a phenomenon apparently anal-

ogous to solarization, but which the author considers due to the unreactiveness of the sensitive plate towards light of certain wave-lengths. G. N. LEWIS.

Studies in Vapor Composition, II. BY H. R. CARVETH. *J. Phys. Chem.*, **6**, 237–256; 321–338.—The paper discusses the experimental attainment of equilibrium in heterogeneous systems containing a vapor phase, and contains a method of obtaining the boiling-point curve and the vapor composition of binary mixtures, a method for the practical separation of two volatile liquids, and a method of obtaining the boiling-point of a liquid in contact with a solid phase. G. N. LEWIS.

Molecular Attraction. BY J. E. MILLS. *J. Phys. Chem.*, **6**, 209–236.—On the assumption that molecules attract each other with a force inversely proportional to the square of their distance apart and independent of the temperature, the author obtains several equations which express a proportionality between the change of internal energy on evaporation and the quantity, $\sqrt[3]{d}-\sqrt[3]{D}$, where d and D are the densities respectively of liquid and vapor. The author shows that his equations hold within certain limits and he concludes that his assumptions are correct. Unfortunately this conclusion is rendered very doubtful by the occasional deviations from the formulas and by the fact that the author introduces other assumptions of doubtful validity besides those stated, such for example as the assumption that the internal latent heat is a true measure of the work done against molecular attractions. The author does not point out the simple relation between the densities of vapor and liquid, and the difference in their specific heats which would be the direct consequence of his equations. G. N. LEWIS.

Synthetic Analysis in Ternary Systems. BY A. W. BROWN. *J. Phys. Chem.*, **6**, 287–312.—The indirect methods previously suggested by Bancroft (*this Rev.*, **8**, 440) of determining the composition of a solid phase separating from a ternary system have been tested experimentally. Several cases in which the solid phases are compounds or solid solutions were studied. The method of plotting results on the triangular diagram is shown together with a method of indicating on the diagram the probable experimental error. The author concludes that with similar care the new methods give better results than direct analysis.
G. N. LEWIS.

On the Stability of the Equilibrium of Univariant Systems. BY PAUL SAUREL. *J. Phys. Chem.*, **6**, 257–260.—The author gives another proof of the two theorems of Roozeboom establishing criteria of stability of univariant systems.
G. N. LEWIS.

On the Fundamental Equations of the Multiple Point. By Paul Saurel. *J. Phys. Chem.*, 6, 261–264.—The author gives a simple mathematical form to Riecke's equations of a multiple point. G. N. Lewis.

On the Triple Point. By Paul Saurel. *J. Phys. Chem.*, 6, 399–409.—Two new methods of obtaining the classification of triple points given by Roozeboom are described.
G. N. Lewis.

On a Theorem of Tammann. By Paul Saurel. *J. Phys. Chem.*, 6, 410–416.—A generalization of a curious geometrical theorem of Tammann regarding the triple point.
G. N. Lewis.

On Indifferent Points. By Paul Saurel. *J. Phys. Chem.*, 6, 313–320.—This is a mathematical discussion of such points as those at which a liquid mixture and its vapor have the same composition. G. N. Lewis.

On the Displacement of Equilibrium. By Paul Saurel. *J. Phys. Chem.*, 6, 467–473.—The author derives eight equations which embody, in his opinion, a more general statement of Le Chatelier's theorem. G. N. Lewis.

On the Critical State of a One-Component System. By Paul Saurel. *J. Phys. Chem.*, 6, 474–491.—A development and amplification of a number of familiar theorems by the aid of the Gibbs energy surface are presented. G. N. Lewis.

On the Critical States of a Binary System. By Paul Saurel. *J. Phys. Chem.*, 6, 629–635.—Deduction from the fundamental assumptions of Gibbs of theorems already given by van der Waals and Duhem. G. N. Lewis.

Absorption, Dispersion, and Surface Color of Selenium. By R. W. Wood. *Phil. Mag.* (6), 3, 607–622.—The author points out that little attention has been paid to substances with absorption bands just beginning in the visible spectrum and extending into extreme ultraviolet. "Glassy" selenium is such a substance. Its refractive index and absorptive power were studied with red and yellow light by means of very acute prisms. For shorter wave-lengths it was necessary to use the interferometer method with films prepared by cathode discharge. The extinction curve is steep, the absorption for short waves being as great as that of metals. The refractive index has a maximum at wavelength 0.0005, where it is 3.13, the highest yet recorded for any substance.

The author gives a preliminary notice of work on nitrosodimethyl aniline, a prism of which is transparent to red and yellow and gives a spectrum twelve times as long as a similar

quartz prism. The substance is, however, almost completely opaque to blue and violet. G. N. LEWIS.

The Solubilities of Some Carbon Compounds and the Densities of their Solutions. BY CLARENCE L. SPEYERS. *Am. J. Sci.*, 14, 293–302.—The experiments recorded were undertaken to determine whether different molecular aggregations of solutes had any connection with their differences in solubility. The solubility of the following substances was determined at various temperatures: urea, urethane, chloral hydrate, succinimide, acetamide, resorcinol, acetanilide, naphthalene, acenaphthene, phenanthrene, benzamide and *p* toluidine; the solvents used being water, methyl alcohol, ethyl alcohol, propyl alcohol, chloroform and toluene. Plots showing the variation in solubility in passing from one solvent to another are given, and it is also shown that the relative solubility of a solute in several solvents can change very much with changing temperature. There appears to be no regularity, however, in the change of solubility as the molecular weights of the alcoholic solvents increase, whether the molecular aggregation of the solutes be regarded or not, nor are the results in accord with Schroeder's formula (*Ztschr. phys. Chem.*, 11, 449 (1893)). The densities of the solutions at various temperatures were determined by the pycnometer. Only urea, acetanilide, naphthalene and acenaphthene were found to exist in the solutions as solutes with normal molecular weights, and from these particular solutions the solubility and density at 27° was ascertained and the osmotic pressure of the solutes determined. The latter is not at all constant for the same solute in various solvents, and the analogy of solution to vaporization is, therefore, far from complete. Plots are given, showing the variation in the molecular volume as the solute passes from one solvent into another. The following observations are made: (1) The molecular volumes of the solutes are larger in water than in the other solvents and decrease in the order of methyl alcohol, ethyl alcohol, propyl alcohol, toluene and chloroform, the only exception being perhaps chloral hydrate in ethyl alcohol compared with its solution in chloroform; (2) the molecular volumes in chloroform show decided constancy for every temperature and concentration observed, and to a lesser extent in toluene; (3) in general, the molecular volumes of the solutes decrease as the temperature rises and the concentration increases, the exceptions being urethane and chloral hydrate in chloroform. M. T. BOGERT.

The Forecast of Chemical Reactions from the Algebraic Signs of the Quantities of Heat Liberated. BY H. LE CHATELIER. *Trans. Am. Inst. Min. Eng.*, 31, 471.—Starting with the science of energetics, we start with the impossibility of creating energy from nothing. Some chemical reactions absorb heat, others, more

numerous than the first, evolve it. At very low temperatures, all possible reactions directly liberate heat; at high temperatures, the possible reactions which absorb heat become more and more numerous. Of all the reactions which can take place, that particular one tends to occur which will develop the greatest amount of exterior work, but it is usually impossible to find out which reaction satisfies these conditions, for want of data. Another way of stating it is that the reaction tending to occur is that in which the heat of reaction diminished by T times S is a maximum, where T is the absolute temperature and S is the variation of the entropy. It is thus seen that the diminishing term increases indefinitely with the temperature and, therefore, the tendency for a reaction to take place diminishes as the temperature increases; in case S is negative, the tendency for the reaction to take place increases as the temperature increases.

J. W. RICHARDS.

INORGANIC CHEMISTRY.

The New Gas From Radium. BY E. RUTHERFORD. *Trans. Roy. Soc. Canada*, 7, 21–25.—The rates of diffusion of the emanation from radium was determined by means of the quadrant electrometer. The method of measuring the activity of the emanation was similar to that used by the author in studying the radioactivity of thoria (*this Rev.*, 25). The rate of diffusion indicated a gas of molecular weight between 40 and 100. This could not have been radium vapor as the molecular weight of radium is greater than that of barium. H. N. McCOY.

The Conversion of Amorphous Carbon to Graphite. BY FRANCIS J. FITZGERALD. *J. Frank. Inst.*, 154, 321–348.—The paper is a review of the most important work on this subject. It treats especially of the commercial method of Acheson by which graphite is produced from anthracite, containing 5 to 6 per cent. of ash, by heating electrically. The resulting graphite is practically pure carbon, all other substances having volatilized at the high temperature employed. H. N. McCOY.

The Conversion of Amorphous Carbon to Graphite. BY F. J. FITZGERALD. *J. Frank. Inst.*, November, 1902.—An exhaustive article of 28 pages giving the complete history of this subject, from the first experiments of Despretz to the last results obtained by Acheson. The discussion of the work of Moissan, and of the various patents covering this field is temperate and fair, and the whole article is a substantial contribution to the literature of this subject. J. W. RICHARDS.

GEOLOGICAL AND MINERALOGICAL CHEMISTRY.

The Anthracite of the Third Hill Mountain, West Virginia. BY WILLIAM GRIFFITH. *J. Frank. Inst.*, **154**, 431–439.—An adverse opinion as to the commercial value of the anthracitic coal beds of Berkeley County. W. F. HILLEBRAND.

Reconnaissance of the Borax Deposits of Death Valley and Mohave Desert. BY MARIUS R. CAMPBELL. *U. S. Geol. Survey, Bull. No. 200*, pp. 22, sketch map.—The various outcrops are not, as some writers have supposed, parts of one extensive sheet of sediment that was deposited in a wide-spread but shallow lake. W. F. HILLEBRAND.

The Geology and Petrography of Crater Lake, National Park. BY JOSEPH SILAS DILLER AND HORACE BUSHNELL PATTON. *U. S. Geol. Survey, Professional Paper No. 3*, 167 pp., 19 plates. —The volcanic rocks of the former Mt. Mazama, the engulfment of which rendered possible the formation of Crater Lake, are andesites, dacites, and basalts, all hypersthene-bearing. The oldest of these are the andesites, of great diversity in external appearance. This diversity is due, both as to color and texture, to variations in the ground mass rather than in the phenocrysts. The four main types, showing all manner of intergradations, are: The hyalopilitic, the hypocrystalline (A and B), the holocrystalline, and the dacitic types. The rocks from this region which have been heretofore always designated as rhyolites, are now to be regarded as dacites. Their groundmass presents a remarkable variety in structure, upon which the most of the distinctions are based. The basalts are very closely allied to, and sometimes hardly distinguishable from, the andesites, although typically developed basaltic structures are found. Accompanying the description are fourteen analyses, by H. N. Stokes, of hypocrystalline and holocrystalline hypersthene-andesites, of hypersthene dacites and secretions found among dacitic ejectamenta, and of hypersthene-bearing basalts of interstitial, porphyritic interstitial, and andesitic types. W. F. HILLEBRAND.

Rickardite, a New Mineral. BY W. E. FORD. *Am. J. Sci.*, **15**, 69–70.—Intimately associated with native tellurium in the Good Hope mine at Vulcan, Colorado, occurs in small lense-shaped masses a telluride of copper. The chief vein mineral is pyrite, with which occur, besides rickardite and tellurium (the latter in unusually large masses), petzite, berthierite, and perhaps roscoelite. One large mass of sulphur was also found. Analysis of the rickardite gave as the mean of two concordant determinations: Cu, 40.74; Te, 59.21. Theory requires 40.51 and 59.49, respectively, for the formula Cu_4Te_3. This is not only a new telluride, but also a new type, the ratio 4:3 being hitherto

unknown in this group. It may be regarded as $Cu_2Te,2CuTe$. The characteristics of the mineral are as follows: Color, shown also on fresh fractures and by the powder, a beautiful purple which rivals the deepest tarnish ever seen on chalcopyrite or bornite. Hardness, 3.5; sp. gr., 7.54. Fusible at 1 and gives a pale azure-blue flame tinged in the outer parts with green. On charcoal, gives a white coating of TeO_2 and fuses to a brittle globule of telluride which yields only with difficulty a globule of copper. In the open tube forms a semitransparent brown mass and gives only a faint sublimate of TeO_2. In the closed tube, fuses without further change. Soluble in nitric acid. Heated with strong sulphuric acid, gives the purple reaction for tellurium.

W. F. HILLEBRAND.

An Occurrence of Free Phosphorus in the Saline Township [Kansas] Meteorite. BY OLIVER C. FARRINGTON. *Am. J. Sci.*, 15, 71–72.—While drilling into this meteorite at a depth of two inches "smoke" of a pungent garlic-like odor became apparent, which emanated from a luminous spot at the bottom of the hole. The fumes blackened silver nitrate, and some of the powder from the drill hole, when treated with nitric acid and ammonium molybdate solution, gave a yellow precipitate. The fumes persisted for two hours and then gradually died away. The phosphorus seems to be locally distributed, for none was met with in other drill holes. The stone, when broken at the end of the first hole, showed a brownish white spot about half an inch in diameter, contrasting with the greenish black hue of the rest of the stone. This first occurrence of free phosphorus emphasizes conclusions which have at times been disputed: that the meteorite was not formed on the earth; that free oxygen was not present when it was formed; and that the interior of the meteorite cannot have been subjected to any high degree of heat since its aggregation into the solid state.

W. F. HILLEBRAND.

Deposits of Copper Ores at Ducktown, Tennessee. BY J. F. KEMP. *Trans. Am. Inst. Min. Eng.*, 31, 244–265.—A paper dealing more especially with the structure of the ore and the order of formation of the minerals of this region, and illustrated by a map, photographs, and photomicrographs.

W. F. HILLEBRAND.

The Great Oil Well Near Beaumont, Texas. BY ANTHONY F. LUCAS. *Trans. Am. Inst. Min. Eng.*, 31, 362–374.—A brief description, by the locator and owner, of the history and the manner of sinking this well, of the control of the oil flow, with geological and chemical reports on the oil rock and the oil itself.

W. F. HILLEBRAND.

The Coal Fields of Northeastern China. BY NOAH FIELDS DRAKE. *Trans. Am. Inst. Min. Eng.*, 31, 492–512.—This paper

is illustrated by several maps and sections, and contains eleven analyses of bituminous and anthracite coals from the Kai-ping and Wang-ping fields. In a discussion on the subject (p. 1009) there is a table of thirty-two additional analyses of Chinese coals taken from *Mining and Metallurgy*, January 15, 1901.

W. F. HILLEBRAND.

Diverse Origins and Diverse Times of Formation of the Lead and Zinc Deposits of the Mississippi Valley. BY CHARLES R. KEYES. *Trans. Am. Inst. Min. Eng.*, **31**, 603–611.—The paper printed in abstract form in *Eng. and Min. J.*, **72**, 597–598, under the title "Contiguity of Ore Deposits of Different Generic Relationships," and noticed in this Journal, **24**, R. 4.

W. F. HILLEBRAND.

The Igneous Rocks Near Pajaro. BY JOHN A. REID. *Bull. Dept. of Geol., Univ. of California, Vol.* 3, *No. 6*, pp. 173–190, 1 plate. —These notes are a contribution to the knowledge of the granitic rocks of the California Coast Ranges. The rocks studied offer a good example of magmatic differentiation. The oldest phase is a fine-grained ultra basic diorite, following which in point of age is the main mass, also a diorite. Here the change from the crystallization of the basic minerals to the acid was sudden. "Through these two rocks were later intruded acid dykes of pegmatite and aplite, high in silica and alkalies, often containing 50 per cent. orthoclase." Although the author considers that the dioritic rocks had best be called diorites, he remarks that their actual nomenclature has "disclosed the lack of conformity in rock classification, and it is hoped these notes may be of some service in calling more careful attention to the general question of the nomenclature of the more basic igneous plutonic rocks." Two analyses of diorites and a few silica determinations of the acid types, all by the author, besides several comparison analyses are given.

W. F. HILLEBRAND.

Rock Basins of Helen Mine, Michipicoten, Canada. BY ARTHUR P. COLEMAN. *Bull. Geol. Soc. Am.*, Vol. **13**, pp. 293–304, 1 plate.—This is an attempt to account for the formation of certain rock-rimmed lake basins by the action of solvents rather than mechanical forces.

W. F. HILLEBRAND.

Igneous Rocks of the Algonkian Series. BY GEORGE I. FINLAY. pp. 349–352, in Stratigraphy and Structure, Lewis and Livingston Ranges, Montana, by BAILEY WILLIS. *Bull. Geol. Soc. Am.*, Vol. **13**, pp. 305–352.—A description, without analyses, of the two igneous rocks of the Siyeh limestone of Mr. Willis' paper—an intrusive diorite and an extrusive diabase—and of boulders of augite-andesite, diabase, melanite, phonolite, and tinguaite, which occur east of Livingston range and in the river drift along the North Fork of the Flathead River.

W. F. HILLEBRAND.

Copper-Bearing Rocks of Virgilina Copper District, Virginia and North Carolina. BY THOMAS LEONARD WATSON. *Bull. Geol. Soc. Am.*, Vol. 13, pp. 353–376. Sketch map and 3 plates.—The author summarizes the principal points developed by his study as follows:

1. "The rocks of the area here described have been greatly altered through pressure and chemical metamorphism, as indicated in the prevailing secondary schistose structure and the abundant development of the secondary minerals—chlorite, epidote, and hornblende—and small amounts of others. The alteration has advanced sufficiently far in the schistose phase to destroy in most cases the original structure and minerals of the rock. 2. From structural, petrographic, and chemical evidences the rocks are shown to have been derived from an original andesite, but in their present much altered state they are, according to present usage, more properly designated meta-andesites; that these are intimately associated with the corresponding volcanic clastics. Furthermore, the popular name greenstone applied to many areas of greatly altered massive and schistose rocks along the Atlantic Coast and Lake Superior regions, shown to have been derived from an original basic eruptive rock type, has equal application to the existing rocks of the Virgilina district. 3. The rocks are pre-Cambrian in age and represent an area of ancient volcanics similar to others described as occurring along the Atlantic Coast region from eastern Canada to Georgia and Alabama, and in the Lake Superior region. 4. The rocks are cut by numerous approximately parallel quartz veins which contain workable copper deposits. The veins have been described as true fissure veins, and the ore is glance and bornite, without chalcopyrite and pyrite." Seven analyses by the author aid the text, and numerous others are quoted in comparison.

W. F. HILLEBRAND.

The Mineral Waters of Indiana, with indications for their therapeutic application. BY ROBERT HESSLER. *Trans. Indiana State Med. Soc.*, 1902.—From tables in the possession of the state geologist, the author has been able to group the mineral waters of the state, so far as analyzed, according to the amounts and kinds of solids and their geological derivation, and has given some advice regarding their use and that of waters in general.

W. F. HILLEBRAND.

ANALYTICAL CHEMISTRY.

Separation of Lead from Manganese by Electrolysis. BY A. F. LYNN. *Am. Chem. J.*, 29, 82.—The author has previously shown (*J. Am. Chem. Soc.*, 24, 435), that lead may be completely deposited by the electrolysis of a solution of its phosphate

in an excess of phosphoric acid. Manganese is not deposited from a similar solution. To a definite amount of lead and manganese in solution as nitrates, "sodium hydrogen phosphate" is added, and the precipitate formed is dissolved in an excess of phosphoric acid solution (sp. gr. 1.70). This solution is acted on by currents varying from 0.003 to 0.006 ampere per square decimeter at voltages varying from 2.3 to 2.75 in the author's experiments. The time varies from seventeen to twenty-four hours. The amounts of lead and manganese should not exceed 0.1 gram of either in 130 cc. of the electrolyte. The difference between lead found and that taken varies from none to 0.8 per cent. in the ten determinations given. BENTON DALES.

On the Determination of Lead in Ores. BY I. C. BULL. *Sch. Mines Quar.*, July, 1902.—The ordinary fire assay is unsatisfactory; with most ores the results are about 2 per cent. too low; with oxidized ores containing iron, copper, antimony and bismuth, the result may be too high. Six ores were tested, (1) a rich galena, (2) a poorer galena, (3) a poor cerussite ore, (4) a mixed galena and sphalerite, (5) a mixed galena and stibnite, (6) a richer cerussite. The ores were tested by (AA) ordinary assaying, following Ricketts and Miller's "Notes on Assaying," (A) gravimetrically, weighing as $PbSO_4$, (B) gravimetrically, weighing as $PbCrO_4$, (C) electrolytically, weighing as PbO_2, (D) volumetrically, by Alexander's ammonium molybdate method, (E) volumetrically by Koenig's method, (F) volumetrically, by the oxalate or permanganate method, (G) volumetrically, by the dichromate method, (H) volumetrically, by the ferrocyanide method. A summary of the results is as follows:

No. of ore.	Fire assay. (AA)	Lead sulphate method. (A)	Lead chromate method. (B)	Electrolytic precipitation. (C)	Alexander's method. (D)	Koenig's method. (E)	Oxalate method. (F)	Dichromate ferrous method. (G)	Dichromate "hypo" method. (G)	Ferrocyanide method. (H)
I....	76.0	78.65	78.70	78.73	78.78	78.62	77.57	78.75	78.75	78.66
II....	37.0	37.23	37.29	37.35	37.43	37.39	36.67	37.35	37.35	37.30
III ...	9.0	10.75	10.76	10.80	10.82	10.60	9.95	10.75	10.78	10.88
IV....	24.7	18.42	18.43	18.58	18.49	18.44	17.60	18.46	18.48	18.46
V....	26.7	27.23	27.22	27.32	27.40	27.25	26.28	27.29	27.29	27.22
VI....	37.8	38.52	38.49	38.60	38.62	38.64	37.38	38.49	38.59	38.62

The conclusions are that four volumetric methods for determining lead in ores deserve attention, of which it is remarked that the "dichromate" method is more liable to be inaccurate, unless a great deal of time is spent in washing; Koenig's method gives good results with ordinary amounts of impurities, but in some ores is unreliable; Alexander's method is quicker than the preceding and is less affected by large amounts of impurities, while the "ferrocyanide" method is as rapid, and not affected by even extraordinary amounts of impurities, and is recommended as best. J. W. RICHARDS.

The Reduction of Vanadic Acid by the Action of Hydrochloric Acid. BY F. A. GOOCH AND L. B. STOOKEY. *Am. J. Sci.*, [4], 14, 369–376.—The method of determination of vanadic acid by the reducing action of hydrochloric acid gives results that are from 4 to 6 per cent. too low, if the vanadic pentoxide be treated but once with hydrochloric acid of 1.17 to 1.20 specific gravity. Two or three successive treatments of the residue with concentrated hydrochloric acid effects practically complete reduction and gives fairly satisfactory analytical results.

H. N. MCCOY.

Concerning Gas Analysis by Measurement in Constant Volume under Changing Pressure. BY THEODORE WILLIAM RICHARDS. *Proceedings of the American Academy of Arts and Sciences*, 38, 273.—The author describes a simple apparatus for measuring gas volumes at constant volume and at varying pressure according to the method suggested by Hempel, water being used as the confining liquid instead of mercury. The apparatus and the method here described are of pedagogical value, but it is doubtful whether the method will find acceptance among gas analysts, for, judging from the analyses of atmospheric air cited in the paper, the results are not as accurate as those obtainable with an ordinary Hempel burette. L. M. DENNIS.

The Quantitative Determination of Strychnine in Mixtures of Strychnine and Brucine. BY H. M. GORDIN. *Arch. d. Pharm.*, 240, 641.—The alkaloidal mixture (about 0.2–0.3 gram) is dissolved in 15 cc. 3 per cent. sulphuric acid, using the heat of water-bath if necessary. After cooling add 3 cc. of a previously prepared and cooled mixture of equal parts concentrated nitric acid (sp. gr. 1.42) and water. At the end of exactly ten minutes pour the liquid into a separator, make distinctly alkaline with sodium hydroxide solution and shake out the unaltered strychnine three times with chloroform. The combined chloroformic solution is filtered through a small double filter into a tared flask, 2 cc. amyl alcohol added and the liquid entirely driven off. The complete removal of amyl alcohol is effected by placing the flask on a water-bath and passing a current of air across the opening, not into the flask. The flask is then dried at 135°–140° for two hours and weighed. Experiments made with pure strychnine and brucine gave the following close results:

	Strychnine taken.	Strychnine found.
1	0.1325	0.1330
2	0.1406	0.1441
3	0.1009	0.1010
4	0.1199	0.1201

The strychnine recovered is so pure that nothing is gained by titration. J. O. SCHLOTTERBECK.

METALLURGICAL CHEMISTRY AND ASSAYING.

The John Fritz Memorial. *Eng. Min. J.*, November 8, 1902.—The eightieth birthday of the Bethlehem iron-master was celebrated by over 400 engineers at a dinner in New York. A fund of over $4000 was subscribed, which will endow the John Fritz gold medal, to be awarded annually for notable scientific or industrial achievement. The awarding board is composed of four members from each of the four American Societies of Engineers—civil, mining, mechanical and electrical.

J. W. RICHARDS.

The Lignite Deposits of North Dakota. BY F. A. WILDER. *Eng. Min. J.*, November 22, 1902.—All the workable deposits occur as seams in the Laramie clays. These have a thickness of 2000 feet, and coal is distributed throughout it in varying quantities; at one place 16 seams are in 900 feet, one of them 22 feet thick. Many seams are near the surface, and the coal is gotten by stripping off a few feet of clay. Several seams 25 feet thick have been measured, and one is 40 feet. The lignites are brown to dull black, usually show the woody structure, contain no sulphur, about 30 per cent. of moisture, and fall to pieces on drying. They burn like wood, with great heat and little smoke, leaving a gray ash. The output has doubled annually for the past four years. J. W. RICHARDS.

The Briquetting of Minerals. BY R. SCHORR. *Eng. Min. J.*, November 22, 1902.—The total cost of briquetting fine ores and flue dust varies between $0.65 and $1.25 per ton of briquettes; the cost of repairs to the machinery is only a few cents per ton. Ordinary brick presses, with clay as a binder, have gone out of use for this purpose, since they are too slow and the clay undesirable. The two presses used now are the White press and that of the H. S. Mould Co. From 4 to 6 per cent. of milk of lime is used as a binder, the mixture is well-kneaded, and the briquettes dried from six to eight hours in hot air ovens. A 30 horse-power White press will make 80 briquettes per minute, of a total volume of 872 cubic feet, in 10 hours, and weighing 50 to 80 tons. The plunger-type press of the Mould Co. makes 1080 cubic feet in ten hours, rated at 100 tons capacity. In both these presses, the wear is on parts easily replaced. For slag brick, the slag is granulated as it runs from the furnace, by a water jet, and is pressed with milk of lime as a binder, but sometimes with no binder at all. J. W. RICHARDS.

Investigation of Magnetic Fields with Reference to Ore Concentration. BY W. R. CRANE. *Trans. Am. Inst. Min. Eng.*, 31, 405.—A thirty-seven-page paper, dealing with (1) apparatus and methods, (2) magnetic fields, (3) the relative magnetic per-

meability of various minerals. Very interesting are the various shapes of the magnetic field with various shapes of pole-pieces. In testing magnetic permeability, the material to be tested, in sand, is placed in a glass tube. Experiments with iron and steel filings showed such a tube to have one-third the permeability of a solid rod of the same size; for materials of less permeability, approximating that of air, no difference was perceptible. A table is given of the magnetizability of 56 minerals, and constitutes an important contribution to this branch of research.

J. W. RICHARDS.

The Use of the Tri-Axial Diagram in the Calculation of Slags. BY E. A. HERSAM. *Trans. Am. Inst. Min. Eng.*, **31**, 340.—Shows how the diagram may be used in calculating the relative quantities of ores and flux to be used, in a blast-furnace charge, to give a slag of a certain required composition. Calculation with three coordinates permits the use of three ingredients and the fulfilling of three requirements in the slag; a method is shown by which four constituents may be handled. The method is cumbersome and much more indirect than the simple chemical calculation. J. W. RICHARDS.

The Meehan Furnace Top. *Iron Age*, November 20, 1902.—Description of a newly designed top for a blast-furnace, intended to protect the top of the masonry work and provide considerable space above this by which explosions are rendered less dangerous to the top of the furnace. The gas outlets are at the top of this space, on either side. The device permits, also, free expansion of the masonry, and greatly increases the life of the stack.

J. W. RICHARDS.

Electric Concentration and Electric Furnace. *Iron Age*, November 20, 1902.—Description of a new form of magnetic separator, and new form of the Ruthenberg electric furnace, said to be the property of the Salisbury Steel and Iron Co., who will instal them at their ore lands in Herkimer County, New York. The Penna. Steel Co. are installing the Ruthenberg process at Lebanon, Pa. J. W. RICHARDS.

The Electric Smelting of Iron Ore. BY A. J. ROSSIE. *Iron Age*, November 20, 1902.—The author considers that it is possible to treat iron ores so as to obtain cast-iron in an electric furnace, also that the cast-iron is of full market value. The only consideration requiring discussion is the cost of the process. The writer discusses the experimental furnaces of Stassano, and then gives the results obtained by himself in ten weeks continuous running, with carefully weighed charges, measured current and analytical control. He found it to require development of 5,220 calories of heat in the furnace per pound of pig iron made, or 186 horse-power days per gross ton, the heat of combustion of CO to

CO_2 not being utilized in the furnace. The cost of power is, therefore, \$5.60 to \$11.00 per ton of iron, according to the locality. The yield was 87 per cent. of the iron present. The total cost, with power at \$10 per electrical horse-power year, is figured at \$11.76 per ton as against \$12.47 in the blast-furnace.

J. W. RICHARDS.

The Constitution of Cast-Iron. BY H. M. HOWE. *Trans. Am. Inst. Min. Eng.*, 31, 318.—The inquiry is based on the hypothesis that composition governs properties in the case of cast-iron in the same general way and for the same reasons as in steel. The effects of silicon, manganese, etc., and of thermal and mechanical treatment are, moreover, omitted, and those of carbon and iron alone considered. On this basis, there are two kinds of cast-iron, (1) the graphite-less or steel-white cast-iron series, consisting essentially of ferrite and cementite, and (2) the graphitic series, the members of which are simply the steel or the white cast-iron of the graphite-less series, plus graphite. The 23 pages of inquiry do not admit of condensation, and are commended, with the discussion, to all interested in the subject.

J. W. RICHARDS.

Vacuum Casting. BY A. E. FAY. *Iron Age*, November 6, 1902.—A well-written résumé of the various forms of metal casting processes which have proposed casting under diminished pressure. Contains no information absolutely new, but is quite complete. J. W. RICHARDS.

An Automatic Foundry Test for Contraction. BY A. W. WHITNEY. *Iron Age*, November 13, 1902.—A mould is constructed in the form of an inverted frustrum of a cone, the upper diameter 5.642 centimeters, the lower 5.360 centimeters, the height exactly 10 centimeters. The mould is placed on a flat surface, and just filled with metal. When cold, it is picked up, and the casting immediately sinks in the mould. If the top section has contracted 0.282 centimeter, or 5 per cent., it will just pass through the bottom of the mould. Every centimeter which the piece falls, in the mould, represents therefore a contraction of 0.5 per cent. The measurement of the drop in the mould allows the contraction to be measured to a small fraction of 1 per cent. J. W. RICHARDS.

The Microstructure of Iron and Steel. BY W. C. POST. *Iron Age*, November 20, 1902. (Address to the Nat. R. R. Master Blacksmiths' Assoc.)—A good popular article on this subject with nine fine photo-micrographs. J. W. RICHARDS.

Finishing Temperatures of Steel Rails. BY R. W. HUNT. *Trans. Am. Inst. Min. Eng.*, 31, 458.—Reviews the subject historically and concludes that we have now reached the point where

the chemical composition is secondary to the physical treatment of the metal. Approves of the renewal process of re-rolling old rails, believing that the rails thus receiving more work, at a lower temperature than before, will be improved in quality. The rolling at lower temperatures give greater wear on the finishing rolls, and is harder on the hot saws, but the rails are finished free from scale, show more elasticity under the cold-straightening processes, have a closer fracture, finer grain, and wear better. The average finishing temperature of 80-pound rails is 1580° F.

J. W. RICHARDS.

Effect of Heat Treatment on Crucible Steel Containing 1 Per Cent. of Carbon. BY G. W. SARGENT. *Trans. Am. Inst. Min. Eng.*, 31. 303.—A rod was taken $^3/_4$-inch. in diameter, containing 1.033 carbon, 0.327 manganese, 0.233 silicon, 0.020 phosphorus, and 0.016 sulphur. Pieces 4 inches long were annealed inside a porcelain tube, at various temperatures, and tested for strength, elastic limit, etc., and photomicrographs made. A cooling curve was also determined, with the critical point at 675° to 680° C. Its micro-structural constituents were pearlite 95, cementite 5. Thirty-one fine micro-photographs are given, a table of physical properties, and a very clear diagram showing the effect on the physical properties of heating to various temperatures. The maximum tensile strength was in the sample heated to 1025° ; the maximum elastic limit and elongation in that heated to 650°. The author considers micro-structural investigation of very great value in connection with tool steels.

J. W. RICHARDS.

The Effect of Low Temperature on the Recovery of Overstrained Iron and Steel. BY E. G. COKER. *Phys. Rev.*, August, 1902.—Bars were first overstrained in tension, then buried in snow, and taken out from time to time to examine their behavior under stress. The outside temperatures to which they were subjected varied from —9° to 32° F., averaging +15°. *In steel*, the tendency to recover from overstrain is entirely balanced by the opposing effect of the low temperature and *its recovery is*, in consequence, *entirely arrested*. *In wrought-iron*, the condition of *overstrain gradually diminishes* until a point is reached where the tendency to recover is balanced by the opposing action of the low temperature.

J. W. RICHARDS.

Corrosion of Steel Frames of Buildings. BY C. L. NORTON. *Iron Age*, November 6, 1902.—Records experiments on the use of cement in contact with steel, and concludes (1) Neat Portland cement, even in thin layers, is an effective preventative of rusting. (2) Concretes, to be effective in preventing rust, must be dense and without voids or cracks. They should be mixed quite wet where applied to the metal. (3) The corrosion found in cinder concrete is mainly due to the iron oxide, or rust, in the

cinders and not to the sulphur. (4) Cinder concrete, if well rammed when wet, and free from voids, is about as effective as stone concrete in protecting steel. (5) It is of the utmost importance that the steel be clean when bedded in concrete. Scraping, pickling, a sand blast and lime should be used, if necessary, to have the metal clean when built into a wall. The coating of all steel work with cement before applying the concrete or tile or brick is an absolute essential, if the formation of rust and consequent weakening of the steel is to be prevented.

J. W. RICHARDS.

Chromite as Hearth-Lining for a Furnace Smelting Copper Ore. BY W. GLENN. *Trans. Am. Inst. Min. Eng.*, 31, 374.—Chromite is infusible and not attacked by the constituents or any of the fusion products of copper ore. It wears away mechanically slowly, does not become friable when heated nor split up. It cannot be used as sand, as the grains cannot be cemented together, and float up into the matte. Lumps of chromite must, therefore, be used, keyed into a cast-iron concave basin having a flange and strengthened by ribs. The lumps of ore are fitted in as well as possible, the interstices filled with smaller lumps hammered in, and finally the cracks filled in with ground ore. With a furnace of 150 tons capacity, the chromite bottom showed less wear at the end of a twenty-three weeks run than a fire-brick bottom did in one week. J. W. RICHARDS.

A Rapid Assay for Silver and Gold in Metallic Copper. BY G. L. HEATH. *Trans. Am. Inst. Min. Eng.*, 31, 484.—Recommends for refined copper and anodes (not for crude copper or mattes) that one assay ton of the metal be dissolved in nitric acid, add enough chloride to precipitate silver, collect the precipitate on a filter, drain, and the filter, *still wet*, taken from the funnel, 1.5 to 2 grams of powdered lead dusted over the inside, the top of the filter folded down, double thickness outside, and then placed directly on the red-hot cupel on to which some 4 grams of powdered lead has been dusted immediately before. The silver chloride reduces quickly, in the hottest part of the muffle, before the outside envelope has burned off ; there need be no spitting, and test assays will agree within 0.5 ounce of silver per ton. J. W. RICHARDS.

Note on Cheap Gold Milling in Mexico. BY H. F. COLLINS. *Trans. Am. Inst. Min. Eng.*, 31, 446.—Account of extracting 0.0659 ounce of gold per ton of ore, by stamping and amalgamation, at a cost of 38.2 cents per ton, leaving a profit of nearly 80 cents per ton. The stamps were worked by water-power, costing nothing, and the ore was very friable and easily crushed. Half the cost was for labor in mining, and the other half for treatment in the mill. J. W. RICHARDS.

Deficiencies of the Fire Assay for Lead. BY S. S. FOWLER. *Can. Min. Rev.*, October 1902, p. 258.—At the conclusion of an article on ore concentration, some remarks are made on the superiority of wet analysis over the fire assays. Tailings which showed no lead by fire assay, really contained 1.36 and 1.42 per cent. Ores with 5 per cent. of lead may show by fire assay from nothing up to at most 1.5 per cent., showing a loss by this method of 70 to 100 per cent. of the lead present.

J. W. RICHARDS.

The Alloys of Lead and Tellurium. BY H. FAY AND C. B. GILLSON. *Trans. Am. Inst. Min. Eng.*, 31, 527.—The paper describes the ordinary phenomena of range of melting-points in alloying, and compares the unusual behavior of alloys of lead and tellurium. The alloys prepared were analyzed by volatilizing the tellurium as chloride, keeping the temperature close to the melting-point of lead chloride, which gave a convenient, accurate and rapid separation. The loss of tellurium in making the alloys was 2 to 5 per cent. The melting-point of the tellurium was 446°, of lead 322°, and the addition of only 6 per cent. of tellurium to lead raised the melting-point 345°. This is because of the formation of PbTe, with a melting-point of 917° (38 per cent. Te), and its solution in the excess of lead. Above 38 per cent., the PbTe is dissolved in a eutectic alloy containing 78.50 per cent. Te, with a melting-point of 400° ; at 78.5 per cent. Te, the eutectic alone exists; above that, the alloy consists of mixtures of the eutectic with tellurium. J. W. RICHARDS.

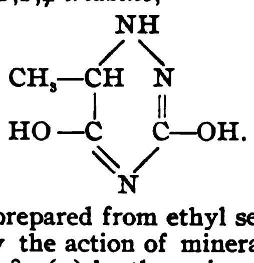
The Alloys of Tellurium and Antimony. BY H. FAY AND C. B. GILLSON. *Trans. Am. Inst. Min. Eng.*, 31, 544.—The freezing-point of the antimony used was 724°, that of the tellurium 446° ; the respective specific gravities were 6.693 and 6.243. Starting with antimony and adding tellurium, the melting-points fall to a minimum of 547° at 25 per cent. tellurium, and then rise to a maximum of 629° at 61.37 per cent. tellurium, corresponding to the compound Sb_2Te_3. Up to this point, the alloy consists of Sb_2Te_3 dissolved in Sb or Sb dissolved in Sb_2Te_3. Above this point, Sb_2Te_3 forms a eutectic alloy with Te at 87 per cent. Te, with a minimum melting-point of 421°, and from 61.37 per cent. Te to this point, the alloy is a mixture of Sb_2Te_3 and eutectic alloy. Above 87 per cent., the alloy is a mixture of eutectic alloy and Te. The specific gravity of antimony is increased by adding Te up to 10 per cent. (6.264), becomes that of Sb at 15 per cent. Te, and thenceforward decreases regularly to that of Te. Fine micro-photographs accompany the paper.

J. W. RICHARDS.

ORGANIC CHEMISTRY.

Ring Condensations of the Esters of Uramido and Semicarbazino Acids with Sodium Alcoholate. BY J. R. BAILEY. *Am. Chem. J.*, **28**, 386–403.—Sodium alcoholate may be employed as a general reagent to effect ring-condensations with esters of uramino or semicarbazino acids, the reaction taking place in the cold, with elimination of a molecule of alcohol, and giving nearly quantitative yields. A useful method of esterification was also discovered for compounds very sensitive to mineral acids, which consists in allowing them to stand in the cold with dilute hydrochloric acid for two weeks or more, and in this way esters were obtained which could not be produced by any of the usual methods. EXPERIMENTAL.—I. *Condensations of the esters of uramido acids to hydantoins* (with C. P. Norby). *Ethyl ester of hydantoic acid.*—This may be prepared from the acid by the esterification method just noted, the yield being 97 per cent. of the theory. If the alcoholic solution be boiled, only hydantoin is formed. The ethyl ester gives the corresponding alkaline salt of hydantoin when treated with sodium or potassium alcoholate. With alcoholic potassium hydroxide, the potassium salt of hydantoic acid, decomposing at about 130°, is produced. *Hydantoic amide*, from the ester and alcoholic ammonia, melts at 204° with evolution of gas. *Hydantoic nitrile* can be obtained by the action of equal molecules of potassium cyanate and of the nitrile of glycocoll chloride in concentrated aqueous solution. It crystallizes from water in prisms, m. p. 139°, and is saponified to hydantoic acid by boiling with baryta water. *Salts of hydantoin.*—By the interaction of equal molecules of sodium alcoholate and hydantoic ethyl ester, in concentrated solutions, the *sodium salt* of hydantoin is immediately separated as a fine pulverulent precipitate, and when purified is sparingly soluble in alcohol, readily soluble in water, and does not deliquesce in the air. The first product of the reaction appears to be of the following structure, $CH_2NHCONHC(ONa)(OC_2H_5)$, which gives the sodium salt of hydantoin when heated, or more slowly *in vacuo*, $CH_2NHCON:CONa$. The *potassium salt* may be obtained in the same way. *Ethyl ester of lacturaminic acid*, $NH_2CONHCH(CH_3)COOC_2H_5$, prepared from the chloride of alanine ethyl ester and potassium cyanate, is readily soluble in water, chloroform or alcohol, difficultly soluble in ether or petroleum ether, and is best purified by crystallization from benzene, giving masses of very slender short needles, m. p. 100°. Treated with sodium alcoholate in alcoholic solution, it is converted to the sodium salt of *lactyl urea*. Both the sodium and potassium salts of lactyl urea separate in gelatinous masses difficult to filter and were consequently not isolated, but by acidifying

the reaction-product slightly with dilute hydrochloric acid, neutralizing with ammonia, evaporating dry and extracting the residue with alcohol, a yield of about 85 per cent. of lactyl urea may be obtained, which, when crystallized from alcohol containing 15 per cent. of ether, melts at 148° (Heinz gives the melting-point, when crystallized from water, as 140°). *Ethyl ester of γ-phenylhydantoic acid*, $C_6H_5NHCONHCH_2COOC_2H_5$, from the chloride of glycocoll ester, sodium bicarbonate and phenyl isocyanate, crystallized from dilute alcohol or from benzene, forms slender needles, m. p. 108°–109°, and gives *γ-phenylhydantoin* when treated with sodium alcoholate. Boiling baryta water changes the hydantoin to *γ-phenylhydantoic acid*, which crystallizes from alcohol in short slender needles, melting at 197° with evolution of gas. II. *Condensations of the esters of semicarbazino acids to triazines.*—Semicarbazinopropionitrile was obtained by the method of Thiele and Bailey with certain modifications, and this was saponified to the corresponding acid by dilute baryta water. The ethyl ester of the latter was prepared by the action of hydrochloric acid gas upon the absolute alcoholic solution of the nitrile at 0°, the imino ether chloride being decomposed by water, the solution neutralized with ammonia and the ester collected with chloroform. In the residual aqueous solution, dihydromethyldioxy-α-triazine was found. *Propyl ester of semicarbazinopropionic acid*, prepared from the nitrile, propyl alcohol and hydrochloric acid gas, as outlined above, is very soluble in alcohol and water, difficultly soluble in benzene, very difficultly soluble in ether. By evaporation of its acetic ether solution, it crystallizes in long slender needles, m. p. 89°. Potassium permanganate, in presence of dilute sulphuric acid, oxidizes it to the *propyl ester of the semicarbazone of pyruvic acid*, $NH_2CONHN : C(CH_3)COOC_3H_7$, m. p. 178°. *Methyl ester of semicarbazino propionic acid*, prepared by esterifying the acid with a dilute methyl alcoholic solution of hydrochloric acid, crystallizes from benzene in radiating bundles of short prisms, m. p. 100°. Potassium permanganate, in dilute sulphuric acid solution, changes the ester to a *semicarbazone* melting with decomposition at 208°. *3,5-Dioxy-6-methyl-1,6-dihydro-1,2,4-triazine*,



This substance was prepared from ethyl semicarbazinopropionate in four ways: (1) by the action of mineral acids; (2) by fusion for three hours at 120°; (3) by the action of potassium hydroxide in absolute methyl alcohol solution (methyl and propyl esters act

similarly); and (4) when concentrated alcoholic solutions of equal molecules of the ester and of sodium alcoholate were brought together the sodium salt of the triazine was immediately precipitated. This sodium salt is very hygroscopic. By boiling the triazine with baryta water, it is changed to semicarbazinopropionic acid. *3,5-Dioxy-6-methyl-1-benzoyl-1,6-dihydro-1,2,4-triazine* is prepared by the action of sodium alcoholate upon the ethyl ester of benzoylsemicarbazinopropionic acid, and crystallizes from alcohol in short microscopic prisms, m. p. 201°; softening a few degrees below this, it resolidifies at about 180° and then shows a melting-point of 210°, probably from passing into a labile form, since this high melting modification when recrystallized from alcohol reverts to the form melting at 201°. Alcoholic ferric chloride solution gives a deep red-brown color with this benzoyl triazine, while heating with a 10 per cent. potassium hydroxide solution changes it to 3-oxy-5-phenyltriazole-1-propionic acid. The *semicarbazone of ethyl pyruvate* (with C. P. Norby) does not condense to a triazine with sodium alcoholate. Hydrochloric acid hydrolyzes it. Semicarbazinopyruvic acid is produced in nearly quantitative yield from semicarbazine chloride and pyruvic acid by boiling with 3 per cent. alcoholic hydrochloric acid. *Semicarbazinoisobutyric acid* (with M. B. Wesson), from boiling the semicarbazinobutyramide with baryta water, crystallizes from alcohol in cubical forms, melting with decomposition at 194°. 1000 parts of alcohol at 25° dissolve about 6 parts, while it is easily soluble in water. The *methyl ester* was prepared by allowing the acid to stand nine days with a 3 per cent. solution of hydrochloric acid in methyl alcohol, and is more or less soluble in the ordinary organic solvents. It crystallizes in bunches of long slender microscopic prisms, m. p. 106.5°. The *ethyl ester* resembles the latter in solubility, and crystallizes from benzene in long microscopic prisms, m. p. 97°. *3,5-Dioxy-6-dimethyl-1,6-dihydro-1,2,4-triazine* (with M. B. Wesson), prepared from the above ester and sodium alcoholate, is readily soluble in water, more difficultly so in alcohol, crystallizing from the latter in thin plates of a silky luster, m. p. 230°. M. T. BOGERT.

On the Relation of Hydriodic Acid and of Its Salts to the Starch and Dextrin Iodides. BY F. E. HALE. *Am. Chem. J.*, **28**, 438–450.—The free iodine in a measured amount of standardized iodine-potassium-iodide solution was precipitated completely by an excess of dilute starch solution, and the amount of potassium iodide removed by the starch iodide was then ascertained by determining the amount left in the solution and subtracting this from the known total present at the beginning of the operation. The results secured indicate the ratio of potassium iodide to iodine in starch iodide as 1 : 4. This is in accord with the work of Mylius and Lonnes. An attempt was made to analyze the starch iodide by treating the washed iodide with excess of arsenite, ti-

trating the excess by iodine (thus determining the iodine in the substance), finding the total amount of potassium iodide present together with the amount introduced during the analysis, and thus, by difference, ascertaining the potassium iodide actually present in the starch iodide. In this way, the ratio of potassium iodide to iodine was found to be approximately 1 : 3.3. A formula for the iodide, corresponding to these analytical results, would be $((C_6H_{10}O_5)_{16}I)_4HI$. *Red starch iodide*, when subjected to a similar examination, gives results indicating that in it the ratio of KI : I is approximately 1 : 2, the author's theory of the structure of these compounds being that, as the blue iodide is changed by concentrated potassium iodide solution to the red form, the group $(KI.I_4)$ is changed to two $(KI.I_2)$ groups, and that the addition of water, which restores the blue color, removes one molecule of the potassium iodide, reducing the two latter groups to the former, thus explaining the change of color to red or blue according as potassium iodide is introduced in excess or is washed out with water. This is not in accord with the suggestion of Mylius that the red iodide contains no potassium iodide and more iodine than the blue form. Amidulin and erythrodextrin show similar color changes with potassium iodide solution. The influence of iodides upon the delicacy of the starch blue test should be borne in mind in standardizing thiosulphate solutions, etc., the presence of a sufficient amount of iodide being much more important than questions of the temperature of the reaction.

M. T. BOGERT.

On the Dibromdinitrobenzols Derived from Paradibrombenzol (Second paper). BY C. LORING JACKSON AND D. F. CALHANE. *Am. Chem. J.*, **28**, 451–474.—By the action of nitric and sulphuric acids upon *p*-dibrombenzene a mixture of dibromdinitrobenzenes is obtained, from which Austen separated two isomers, subsequently shown to be the 2,3- and 2,6-dinitro derivatives of the 1,4-dibrombenzene. The authors have now succeeded in isolating the third possible isomer from this mixture, and have produced proof of its structure as the 2,5-dinitro derivative by reduction to the diamine and oxidation of the diamine to the *p*-dibromquinone. The main product of the nitration, however, is the 2,6-form. The new isomer and the 2,3-dinitro compound were carefully studied. EXPERIMENTAL.—*1,4-Dibrom-2,5-dinitrobenzene* (γ-isomer), as separated from its isomers in the crude nitration-product by the use of various solvents, crystallizes from a mixture of benzene and alcohol in rather slender, long prisms, or in arborescent forms, of faint yellowish cast, m. p. 127°, more or less soluble in most organic solvents except the petroleum distillates and water. It is unattacked by strong hydrochloric or strong sulphuric acids, and is dissolved by hot fuming nitric acid. Reduced with tin and hydrochloric acid, or with zinc dust and acetic acid (not so good), it yields the corresponding diamine. *1,4-Di-*

brom-2,5-phenylenediamine crystallizes from chloroform in large white plates with pearly luster, m. p. 183°–184°, which turn brown in the light, and are soluble in most organic solvents. Mixed with ferric chloride and hydrogen sulphide in dilute acid solution, a *purple product* results, resembling Lauth's violet. The *chloride*, prepared by the action of hydrochloric acid gas upon the dry benzene solution of the diamine, crystallizes from moderately dilute hydrochloric acid in long, slender, white needles of vitreous luster and is not very stable. *1,4-Dibrom-2-nitro-5-aminobenzene* was obtained from the dinitro compound by heating it with alcoholic ammonia in a sealed tube at 100°. It forms deep brownish-yellow prisms, m. p. 174°–175°, insoluble in ligroin, sparingly soluble in cold benzene, more readily in the latter when hot, and hydrochloric acid gas when passed into this benzene solution precipitates a *salt* in yellow needles. Another *substance* was observed as a product of the action of the ammonia upon the dibromdinitro compound, which was soluble in ligroin and melted at 135°–139°, but not enough was obtained for identification. *1-Brom-4-anilino-2,5-dinitrobenzene* results when the dibromdinitrobenzene is heated on a steam-bath with excess of aniline. It crystallizes from alcohol and benzene in six-sided orange-red plates, m. p. 153°–154°, which dissolve in the ordinary organic solvents except ligroin. *Dibromnitrophenetol* is produced by the action of a cold solution of sodium ethylate upon the dibromdinitrobenzene, and crystallizes from alcohol in slender prisms, m. p. 126°. It is soluble in most organic solvents. If the sodium ethylate acts upon the boiling benzene solution of the dibromdinitro compound, it replaces not only a nitro group but also a Br by the ethoxy group, giving a substance which is probably the *4 brom-6-nitro-resorcindiethylether*, and which crystallizes from dilute alcohol in sheaves of pointed yellowish-white needles, m. p. 103°–104°, dissolving more or less freely in the usual organic solvents. The action of hot sodium hydroxide solution upon dibromdinitrobenzene appears to be similar to that of hot sodium ethylate solution. *1,4-Dibrom-2,3-dinitrobenzene* (α-isomer). This isomer, when dissolved in benzene and treated cold with two molecules of sodium ethylate, yields *2,5-dibrom-6-nitrophenetol*. The latter crystallizes from ligroin in long, thick, transparent, lemon-yellow prisms, very soluble in all organic solvents, slightly soluble in water. Its m. p. is 45°. Fuming nitric acid dissolves the substance; on dilution, *white crystals* of what appears to be a new compound are precipitated. If the sodium ethylate acts upon a boiling benzene solution of the dibromdinitrobenzene, some of the bromine is removed as well as one of the nitro groups, but the products were not isolated or identified. Alcoholic ammonia at 100° likewise removes a part of the bromine, while boiling with aqueous sodium hydroxide gives the *2,5-dibrom-6-nitrophenol*. This phenol forms bright golden yellow needles, m. p. 77°, and dissolves in the ordi-

nary solvents. Its *barium salt* separates from aqueous solutions in small yellow crystals, carrying three molecules of water, most of which can be removed *in vacuo*, the color then changing to brown. It is only slightly soluble in water. M. T. BOGERT.

On the Azoxybenzaldehydes. BY F. J. ALWAY. *Am. Chem. J.*, **28**, 475–480.—The author has already proved that the compound obtained by Gattermann (*Ber. d. chem. Ges.*, **29**, 3037 (1896)) is identical with Kirpal's "*p*-azoxybenzaldehyde." That this substance is really *p*-azoxybenzaldehyde is now further proved by its conversion to an oxyazo body. It is also shown that the *p*-azoxybenzaldehyde produced by the patented process of Lucius and Brüning is likewise identical with the substance obtained by Kirpal and Gattermann. The *m*-azoxybenzaldehyde was also prepared and studied. EXPERIMENTAL.—*The conversion of p-azoxybenzaldehyde into an oxyazo compound* may be accomplished by heating the concentrated sulphuric acid solution of the aldehyde for some time at 110°–120°. The product is a brown solid, showing the characteristic behavior of the oxyazo compounds. *The electrolytic reduction of m-nitrobenzaldehyde* proceeds in the same manner as for the para compound (*Am. Chem. J.*, **28**, 34), except that it is much less easily accomplished, the primary reduction-product being the *N-m-formylphenylether of m-nitrobenzaldoxime*, $(m)NO_2.C_6H_4.\overset{O}{\widehat{CH.N}}.C_6H_4.COH(m)$, which separates from boiling pyridine as a grayish granular solid. The secondary reduction-product is a light brown, amorphous, *insoluble solid*, probably an azoxy compound, the filtrate from which gives a *red precipitate* with sodium carbonate. By the action of ferric chloride upon the above primary reduction-product, Gattermann obtained, together with other substances, a small amount of an unidentified body. The author has now identified this as the *m*-azoxybenzaldehyde, and explains, by reactions, the probable manner of its formation. Heated with dilute mineral acids, the formylphenylether yields *m*-nitrobenzaldehyde and a small amount of the azoxyaldehyde. The insoluble secondary reduction-product, oxidized by ferric chloride, gives *m*-nitroso and *m*-azoxybenzaldehyde, but only the latter is obtained when the substance is boiled with dilute mineral acids. *m-Azoxybenzaldehyde* may be prepared by treating the primary or secondary reduction-products of the nitro aldehyde with ferric chloride or with dilute mineral acids, or also by reduction of the nitro aldehyde with zinc dust and ammonium chloride solution in the cold. The azoxy aldehyde forms nearly colorless needles, m. p. 129°, insoluble in cold water or ligroin, sparingly soluble in ether, hot water or cold alcohol, very readily soluble in benzene, acetic acid or hot alcohol. Its *phenylhydrazone* crystallizes in small orange needles, m. p. 198°. M. T. BOGERT.

Camphoric Acid. Camphanic and Camphononic Acids (Thirteenth paper). BY WILLIAM A. NOYES AND ROBERT C. WARREN. *Am. Chem. J.*, **28**, 480–486.—*Hydroxycamphoric acid.* By heating camphanic acid for twenty-four hours with 10 per cent. sodium hydroxide solution, 96 per cent. was converted to the sodium hydroxycamphorate. The *diethyl ester*, prepared from the silver salt and ethyl iodide, is an intensely bitter liquid; sp. gr. 1.0351 at 20°, $[\alpha]_D = 40°$ at 20° or 39.6° at 28°, and is oxidized by nitric acid to camphanic ester. *i-Bromcamphoric anhydride* was prepared by heating camphoric anhydride on the water-bath with pentachloride and oxychloride of phosphorus until all had liquefied, cooling, adding bromine, and continuing as described by Aschan. *i-Camphanamide*, $H_2NCOC_8H_{13}\left\langle\begin{matrix}CO\\ | \\ O\end{matrix}\right.$, obtained from the foregoing by the action of strong, cold ammonia solution, crystallizes from alcohol in plates or prisms, m. p. 196°. *i-Camphononic acid*, $O:C_8H_{13}COOH$, prepared from camphanic amide by a modification of the method used by Lapworth and Lenton for the preparation of the active acid, melts at 232°. Its amide, obtained from the acid by treatment with phosphorus trichloride, followed by strong ammonia (at —15°), and crystallized from benzene, melts at 215°. *i-Camphoric imide*, $HN\left\langle\begin{matrix}CO\\ \\ CO\end{matrix}\right\rangle C_8H_{14}$, crystallizes from water in needles melting at 249. *i-α-Camphoramidic acid*, $H_2NCOC_8H_{14}COOH$, results when an alcoholic solution of *i*-camphoric anhydride is treated with ammonia gas. Its melting-point is 198°. *i-Aminolauronic acid*, $H_2NC_8H_{14}COOH$. Its *chloride* was prepared exactly as the chloride of the active acid. It melts with decomposition at 266°, and when distilled with lime gives the *anhydride* $\left|\begin{matrix}CO\\ \\ NH\end{matrix}\right\rangle C_8H_{14}$. The latter, when crystallized from ligroin, melts at 209°. *i-Nitrosoaminolauronic anhydride*, $\begin{matrix}ONN\\ | \\ OC\end{matrix}\Big\rangle C_8H_{14}$, from the action of nitrous acid upon the preceding, crystallizes from alcohol in lemon-yellow prisms, m. p. 138°. M. T. BOGERT.

Derivatives of Phenylether. IV. BY ALFRED N. COOK AND GUY C. FRARY. *Am. Chem. J.*, **28**, 486–490.—*4-Nitro-3′-methylphenylether*, $(p)NO_2.C_6H_4.O.C_6H_4.CH_3(m)$, from potassium *m*-cresolate and *p*-bromnitrobenzene at 130°–140°, when purified by fractional distillation under diminished pressure and crystallization from alcohol, forms a light yellow crystalline substance, m. p. 60°–61°, b. p. 230°–233° at 30 mm., and is entirely destroyed by oxidation with chromic acid in acetic acid solution. *Sulphonic acid of 4-nitro-3′-methylphenylether*, prepared from the

latter by direct sulphonation at 100°, crystallizes from water in warty aggregations of fine white needles, m. p. 135°. *Barium salt*, fine white powder, 1000 parts of water dissolve 38 parts of the salt at 24° and 276.5 parts at 80°. *Strontium salt*, fine white powder, more soluble than the barium salt. *Copper salt*, with four molecules of water, crystallizes from water in light green crystals. *4-Amino-3'-methylphenylether* is obtained by reducing the nitro body with tin and hydrochloric acid in alcoholic solution, and is stable when dry but decomposes partly on drying. Its *chloride* crystallizes in colorless needles which shrivel at 146°; the *nitrate* forms feathery crystals; the *sulphate* separates in fine white crystals. By the action of concentrated nitric acid at 90° upon the nitromethylphenylether, a *dinitro body* is produced which separates from alcohol as a yellow crystalline substance, m. p. 103°–104°. Its analysis corresponds to the formula $C_{13}H_{10}O_6N_2$. M. T. BOGERT.

The Industrial Development of Indigo. BY J. MERRITT MATTHEWS. *J. Franklin Inst.*, **154**, 423–429.—A popular presentation of the subject, including a brief outline of the work done to establish the formula of indigotin and the modern commercial methods for producing it artificially.

M. T. BOGERT.

Hydrolysis of Triacetylglucose by Enzymes. BY S. F. ACREE AND J. E. HINKINS. *Am. Chem. J.*, **28**, 370–386.—It has been shown by the authors, in a previous paper (*Dental Cosmos*, June, 1901), that by the culture of certain bacteria in media containing glucose, lactose, etc., not only organic acids were produced but also esters of these acids with the sugar. It appeared of interest, therefore, to determine whether the bacteria themselves, or enzyme-like bodies excreted by them, were responsible for these changes. The investigation has been begun by studying the action of commercial enzymes (pancreatin, amylopsin, emulsin, diastase, and taka diastase) upon triacetylglucose, and it has been discovered that these enzymes hydrolyze triacetylglucose into acetic acid and glucose, and likewise, apparently, cause the two to condense again to triacetylglucose, the process, therefore, being a reversible one. EXPERIMENTAL.—Sterilized solutions of glucose and acetic acid, and of pancreatin, after standing several days, were shown to have suffered no fermentation or change of any kind. A dilute solution of triacetylglucose, which titrated N/42.44 acid, remained unchanged at 0°; at 37° a slight hydrolysis occurred, the solution finally becoming constant at N/33 acid. As these solutions are all stable at 0°, changes taking place at this temperature after the addition of the enzyme solution must be due to the enzyme. 100 cc. of the triacetylglucose solution were treated with 0.5 to 1 gram of enzyme, the solution kept at 0°, and titrations made at regular intervals. In every case hydroly-

sis of the triacetylglucose into glucose and acetic acid was observed. Pancreatin appears to be most active of the enzymes in this respect, its activity at 37° being just double that at 0°. The amount of hydrolysis produced is nearly proportional to the amount of enzyme used, and is never complete. From the few experiments carried out in this direction, pancreatin also appears capable of effecting the union of glucose and acetic acid to the glucose ester. M. T. BOGERT.

BIOLOGICAL CHEMISTRY.

On the Quantitative Determination of Ammonia in the Urine. BY PHILIP SHAFFER. *Am. J. Physiol.*, **8**, 330–355.—The Schlösing method, as described in text-books, is unreliable and its results are usually incorrect. The method depends upon certain conditions which have been entirely disregarded by previous workers. By fulfilling these conditions, results may be obtained which are satisfactory for clinical purposes. The methods of vacuum distillation as described by Wurster, Nencki, and Zaleski, and Söldner may give correct results, but, owing to practical difficulties, simpler methods are to be preferred. The method published by Folin in 1901 is inaccurate. The new method by Folin gives accurate and reliable results. The old but unknown method of Boussingault is quite as accurate as the other vacuum distillation methods and less cumbersome. With the use of modifications which are proposed, the Boussingault vacuum distillation method is quick and free from difficulty, and its results accurate. For scientific or other careful work the recent Folin method, or the modified vacuum distillation method should be used. With either of these methods a higher degree of accuracy than has yet been attained in ammonia determinations is easily possible. F. P. UNDERHILL.

On Adrenalin Glycosuria and Certain Relations between the Adrenal Gland and Carbohydrated Metabolism. BY C. A. HERTER AND A. J. WAKEMAN. *Am. J. Med. Sci.*, **125**, 46–61; also *Virchow's Archiv.*, **169**, 479–501.—The adrenalin used in these experiments was, for the most part, the commercial adrenalin in the form of the chloride in solution 1 : 1000. The experiments were all carried out on dogs.

The intensity and duration of adrenalin glycosuria depend, in part, on the mode of administration and in part on the dose. Subcutaneous injections yield less sugar than intravenous and intraperitoneal injections. Direct application of adrenalin chloride to the surface of the pancreas calls forth glycosuria. The slightest glycosuria is induced by giving by way of the mouth. The degree and duration of the glycosuria vary widely in different animals and sometimes in the same animal at different times.

The duration of the glycosuria following a single dose is seldom longer than thirty hours, and during this time there is an excretion of sugar (glucose) which does not exceed 2 to 3 grams. The differences in susceptibility of different dogs and the same dogs at different times appear to be connected with the state of nutrition of the animal and more especially with the quantity of glycogen stored in the body. The cause of glycosuria after injection of adrenalin chloride is not yet definitely settled, but the pancreas stands in a more or less intimate relation to the phenomenon. Compression of the pancreas will also call forth glycosuria, as will compression of the adrenal gland. In a former paper, authors put forth the idea that by compression of the latter gland an oversupply of adrenalin was poured into the blood and led to glycosuria. In the present paper this theory has been overthrown. F. P. UNDERHILL.

On Saline Diuresis. BY ARTHUR R. CUSHNY. *J. Physiol.*, **28**, 431–448.—The absorption from the renal tubules in the rabbit, when the outflow is obstructed, is differential, the water and chlorides returning to the blood much more readily than the sulphates, phosphates, urea, and pigment. The presence of these last in the glomerular secretion must, therefore, tend to retard the absorption of water by opposing osmotic resistance to the absorbing force. When, as after their intravenous injections, they are present in large amounts, the urine is increased more than when such permeating bodies as the chlorides are in excess. If the absorption in the tubules under normal circumstances is similarly differential, as appears probable, this is sufficient explanation of the variation in the diuretic action of different salts. The saline diuresis appears to be due not to stimulation of excretory cells in the kidney primarily, but to changes in the circulation of the kidney; for when these are excluded, the injection of salt solutions causes little or no change in the urine, and on the other hand, an increase in the volume of the blood without change in its constituents appears sufficient to induce diuresis.

F. P. UNDERHILL.

The Antihemolytic Action of Blood Serum, Milk and Cholesterin upon Agaricin, Saponin, and Tetanolysin together with Observations upon the Agglutination of Hardened Red Corpuscles. BY HIDEYO NOGUCHI. *Univ. Penn. Med. Bull.*, November, 1902.—Blood serum and milk exert more or less antihemolytic action against certain phytohemolysins and bacterial hemolysins, and their action is non-specific. The manner of antihemolytic action of serum and milk agrees with the manner of action of cholesterin and lecithin against these hemolytic agents. It is highly probable that this antihemolytic action of serum and milk depends either wholly or in part upon their cholesterin constituent. Agaricin contains a hemolytic principle

of considerable activity. Hardened red corpuscles may still be agglutinated by ricin, venom-agglutinins, and serum agglutinins.

F. P. UNDERHILL.

An Experimental Study of the Chemical Products of Bacillus Coli Communis and Bacillus Lactis Aerogenes. BY LEO F. RETTGER. *Am. J. Physiol.*, 8, 284–294.—*Bacillus coli communis* and *bacillus lactis aerogenes* fail to bring about very marked decomposition in peptone bouillon. On the other hand, an egg-meat mixture undergoes rapid and extensive transformation. Common products of the colon bacillus are indol, skatol, phenols, aromatic hydroxy acids, skatol-carbonic acid, hydrogen sulphide, mercaptan, tyrosin, leucin, tryptophan. Albumoses and peptones are present in very small amounts. Diamines were not found. *Bacillus coli communis* causes more rapid and more profound decomposition than *bacillus lactis aerogenes*. Indol is a product of both organisms, while the colon bacillus alone produces mercaptan and phenols during the first few weeks. When the bacterial digestion progresses beyond a certain point, the intermediate products (peptone, amino acids, indol, etc.) gradually disappear from the mixtures. Indol may, however, persist for a long time. This disappearance of the more intermediate products is evidently due to their further cleavage and the formation of still simpler bodies, yielding, ultimately, carbon dioxid, water, methane, etc.

F. P. UNDERHILL.

The Interaction of the Blood of Cold-Blooded Animals, with Reference to Hemolysis, Agglutination, and Precipitation. BY HIDEYO NOGUCHI. *Univ. Penn. Med. Bull.*, November, 1902.—The serum of many cold-blooded animals contains both agglutinins and hemolysins. The serum of some cold-blooded animals contains precipitins. The amount of any one of these substances in any given serum is no measure of the amount of either of the other principals. The serum of some species of animals, while strikingly agglutinative for certain kinds of corpuscles, may be entirely or almost devoid of hemolysins for these or even other kinds of corpuscles. Conversely, the occurrence of active hemolysins in a given serum is likely to be attended with the existence of marked agglutinating properties for some species of corpuscles. From this manner of action, the conclusion that a multiplicity of agglutinins and hemolysins occur in serum is rendered highly probable. The agglutinins are active upon red and white corpuscles irrespective of whether the animal yielding them possesses both red and white, on only white corpuscles. The hemolysins are erythrolytic, if obtained from animals possessing red and white corpuscles, while in certain animals possessing only white corpuscles, hemolysins, in contradiction to agglutinins are wholly or almost entirely absent. The serum of certain warm-blooded animals, *e. g.*, the horse, exhibits agglutinating power

over the red corpuscles of some species of cold-blooded animals, and causes slight precipitation with a few kinds, at least, of serums of these animals. F. P. UNDERHILL.

On the Influence of Calcium and Potassium Salts upon the Tone of Plain Muscle. BY PERCY G. STILES. *Am. J. Physiol.*, **8**, 269–273.—The muscle employed in these experiments was a strip taken from the stomach of a frog. Calcium and potassium chlorides were the salts used. The results show that calcium chloride causes increase in tone, whether it is brought to the contractile tissue in small amounts or in concentrations as great as 0.3 per cent. Up to this strength of solution the rise in tone proceeds regularly and hand in hand with the increasing calcium content of the bath in which the muscle is immersed. For concentrations of potassium chloride below 0.15 per cent. there is a depressing effect upon the tone of the muscle. When the concentration passes above 0.2 per cent., the tone is heightened by the potassium chloride just as it is by calcium chloride. With concentrations of 0.3 per cent. or 0.4 per cent. of potassium chloride, the tone is intense. Thus it appears that calcium and potassium have an antagonistic action when each is present in a low concentration, but each acts to cause tonic contraction when a somewhat larger amount is present. F. P. UNDERHILL.

A Study of Immunization, Hemolysins, Agglutinins, Precipitins and Coagulins in Cold-Blooded Animals. BY HIDEYO NOGUCHI. *Univ. Penn. Med. Bull.*, November, 1902.—Artificial hemolysins, agglutinins, anti-agglutinins, serum-precipitins, aqueous humor precipitins, and milk coagulins can be produced through immunization in certain cold-blooded animals. The hemolysins and agglutinins for erythrocytes can be produced in animals which do not possess erythrocytes. Iso-agglutinins and iso-hemolysins can be produced in certain species of turtle. The iso-bodies thus developed have a slight erythrolytic action upon the blood of other, though related, species of turtles. The complements of turtle's blood are rendered inactive by a temperature of 50° C., maintained for thirty minutes. The precipitins and coagulins for aqueous humor and milk, respectively, can be produced in animals which do not possess the corresponding fluids in the strict sense. The above facts demonstrate the wide-spread distribution of common receptors through the animal kingdom, and extend the chief tenets of Ehrlich's hypothesis to vertebrates and invertebrates among the cold-blooded animals.

F. P. UNDERHILL.

On Differences in the Direction of the Electrical Convection of Certain Free Cells and Nuclei. BY RALPH S. LILLIE. *Am. J. Physiol.*, **8**, 273–284.—Isolated cells and nuclei suspended in cane-sugar solution, through which an electrical current is passed,

migrate in some cases with the negative stream, in others with the positive stream. The majority of such structures migrate with the negative stream; this tendency is especially strong in free nuclei and structures consisting chiefly of nuclear matter. The speed of migrations of sperm-heads, thymus-nuclei, and lymphocytes decreases in the order named, showing a parallelism with the decrease in staining property or degree of acidity of the chromatin. Cells with voluminous cytoplasm—large leucocytes, many red blood-corpuscles, involuntary muscle cells, and in some cases Sertoli cells tend to move with the positive stream. The possibility is pointed out that this difference may be due to a general contrast in the electrical properties of the colloids composing nuclear chromatin and cytoplasm respectively; a few of the possible consequences of such a condition are briefly indicated.

F. P. UNDERHILL.

PHARMACEUTICAL CHEMISTRY.

The Alkaloids of Eschscholtzia Californica. BY R. FISCHER AND M. E. TWEEDEN. *Pharm. Archives*, 5, 117.—Six kilograms of the dried herb, and 1 kilogram of the dried root were exhausted with 2.5 per cent. acetic acid, the percolate made alkaline with ammonia, filtered from the small precipitate, and exhausted with chloroform. The residue left upon evaporation of the chloroform was dissolved in alcohol and allowed to evaporate spontaneously. By fractional crystallization, two new alkaloids, designated as *a* and *b*, were isolated in addition to protopine, β- and γ-homochelidonine. The authors did not make combustions of the new alkaloids, but determined their melting-points and their behavior with general alkaloidal reagents. Alkaloid *a* melts at 242°–243° (uncorr.) and alkaloid *b* at 217° (uncorr.). So far, seven alkaloids have been found in Eschscholtzia, *viz.*, protopine, β- and γ-homochelidonine, alkaloid *a*, alkaloid *b*, sanguinarine and chelerythrine.

J. O. SCHLOTTERBECK.

The Alkaloids of Dicentra Cucullaria. BY R. FISCHER AND O. A. SOELL. *Pharm. Archives*, 5, 121.—By a process similar to the above, 500 grams of the bulb, and 1 kilogram of the herb were extracted and after tedious and prolonged manipulation three distinct alkaloids were separated as follows: protopine, m. p. 206°–207°, alkaloid *c*, m. p. 230°–231° (uncorr.), alkaloid *d*, m. p. 215° (uncorr.). The investigation is being continued.

J. O. SCHLOTTERBECK.

Theocine, the First Vegetable Alkaloid Manufactured on a Large Scale by Simple Synthesis. BY DR. HUGO SCHWEITZER. *Am. J. Pharm.*, 75, 27.—Theocine is theophylline, one of the natural alkaloids of tea. For commercial reasons the alkaloid has been rechristened. This will, of course, distinguish the

synthetic from the natural product. The process of manufacture is not given but it is stated to be based upon Wilhelm Traube's research, published in the *Ber. d. chem. Ges.*, **33**, 3053. The synthesis is accomplished in about twelve reactions, and upon such a scale and price as to render its introduction into medicine feasible. The properties of theocine are described as follows: Beautiful colorless needles having a melting-point of 268° C.; difficultly soluble in cold water and alcohol, more readily in warm water; insoluble in ether. It is more soluble in cold water than theobromine, dissolving in the proportion of 1–179 parts as compared with 1–1600. Theocine forms salts, of which the ammonium and potassium salts dissolve readily. Theocine has been found to be the most powerful diuretic of this class of vegetable alkaloids. Synthetic theobromine will also shortly be introduced into medicine. J. O. SCHLOTTERBECK.

The Color-Compound of Stylophorum Diphyllum and Chelidonium Majus. BY J. O. SCHLOTTERBECK. *Am. J. Pharm.*, **74**, 584.—After removing the white alkaloids from the root of Stylophorum, the drug was perçolated with hot water which dissolved out a crystalline, yellow coloring-matter. This coloring-matter was found to be identical with the yellow coloring-matter of Chelidonium, named chelidoxanthin. Furthermore, it was found that this yellow compound is the alkaloid berberine. The name chelidoxanthin should be dropped.

J. O. SCHLOTTERBECK.

SANITARY CHEMISTRY.

Typhoid Fever and Drinking Water. BY A. SEIBERT. *New York Medical Journal*, **76**, 932–938 (1902).—Charts are given showing that during the past ten years the deaths from typhoid fever in New York City, and in the Prussian Army reached the maximum in September, and consequently the maximum infection period is during the hot summer months. This result cannot be due to direct action, but to indirect action of heat, first on the human system in the increase of thirst, causing a greater consumption of water, second in causing an increase of the number of typhoid bacilli in water. The relationship between the use of impure water and typhoid fever is shown by a number of diagrams where the typhoid mortality of each year from 1891 to 1901, is figured out on the scale of 1 to 1,000 inhabitants. In Boston, New York and Brooklyn, using unfiltered water taken from thinly populated water-sheds, the death-rate is 1 in 8,000. In Philadelphia and Baltimore, using unfiltered water taken from streams into which sewage is emptied, the death-rate is 1 in 5,000. In Chicago in 1891, using water of the lake taken comparatively near outfall sewers, 1 in 450; since, using water taken from a point much

further out in the lake, 1 in about 7,500. In Berlin, 1843–1852, using unfiltered water, 1 in 900. 1883–1892, using in part filtered water, 1 in 9,000. Since 1893, using entirely filtered water, 1 in 50,000. Similar results are shown for Hamburg, Magdeburg and Breslau. The results of the investigation are summed up as follows: "All rivers, brooks and lakes located in populated districts of the United States and Germany have long since become permanently infected by the typhoid bacillus. The chief carrier of typhoid germs into the human system is the drinking water to cities and towns. All cities and towns which are compelled of take their drinking water from lakes, rivers or brooks are in duty bound to clean the same by sand filtration at the water works."

LEONARD P. KINNICUTT.

Pollution and Self-Purification of the River Severn at Shrewsbury, England. BY GEORGE C. WHIPPLE. *Eng. Record*, **46**, 511–512 (1902).—This is a review of Prof. Boyce, and Drs. MacConkey, Grunbaum and Hill's paper which was published in the second report of the Royal Commission on Sewage Disposal. Shrewsbury is a town of about 29,000 inhabitants located at a point on the Severn River where the minimum flow is about 85,000,000 gallons per day, and the maximum flow something above 1,000,000,000 gallons. The sewage of Shrewsbury, 884,000 gallons per day, is discharged untreated into the river. The only important source of pollution of the river above Shrewsbury, is from the County Asylum, and in the investigation regarding self purification, examinations of the water at various points on the river, and of the stream deposits were made, more prominence being given to bacteriological than chemical data. The general result of the analyses of the water show that the character of the water generally improves until at Cressage, 18 miles below Shrewsbury, the total number of bacteria is lower than at the County Asylum, though the number of *B. coli* is somewhat greater, which, however, may be due to small feeders of the stream which are not entirely free from *B. coli*. The amounts of free and albuminoid ammonia are also still a little larger than at the asylum. The authors attribute the improvement in the quality of the water below the town, to dilution, sedimentation, the straining action of aquatic plants, and the influence of some of the lower forms of microscopic life. In order to determine at what points in the stream the more solid portions of the polluting substances tend to settle, a large number of colored corks were placed in the stream. After fifteen hours the positions of the corks were noted, and it was found that for the most part they had lodged over heavy deposits of mud, and that this mud was blacker and more offensive than elsewhere in the stream. Analyses of the mud bacteriologically showed that it was seriously contaminated as far as Ironbridge, 22 miles from

Shrewsbury and also indicated how at times of flood these deposits may become secondary sources of pollution.

LEONARD P. KINNICUTT.

The Practical Operation of Sewage Purification Plants. BY JOHN W. ALVORD. *Eng. Record,* **46,** 537–540 (1902).—The paper first discusses the cause of failure of many well-designed sewage plants, then the action of septic tanks and contact beds, and the necessity of their being carefully operated, the use of automatic devices in applying septic tank effluent to intermittent sand filtration beds, and concludes with a brief description of plants used for the bacterial purification of sewage at Wauwatosa, Wis., Holland, Mich., Glen View, Ill., Princeton, Ill., Highland Park, Ill., Danville, Ky.

The chief cause of failure of well-designed plants is the idea very often held, that a plant when once put in operation needs no particular supervision, while just the opposite is true, and to obtain good results a purification plant based on biological processes must be under the charge of a man who knows the kind, quantity, and conditions of the sewage to be treated, and understands how the plant should be run to meet these varying conditions. The chief action of the septic tank is to break down the suspended matter so that it can be more easily handled on contact or intermittent filtration beds, and this can be achieved only by properly designed tanks, carefully operated. The idea that the time allowed for septic action should be the same for various kinds of sewage is incorrect and the time of flow through a septic tank must be regulated for varying conditions, a long period for strong sewage, a shorter period for weaker sewage. This control can be accomplished by the use of the Alvord tank, a tank divided into lateral compartments of varying size, opening into each other.

Though much is known about the action of contact beds, much still remains that might properly be investigated, and the idea that standard lengths of time, as for instance, four hours, should be the time for all sewage to remain in contact with the filling material, is not in accordance with what we know of the fluctuations in the character of the sewage. In the construction of contact beds, great care should be taken as regards leakage. A slight leakage anywhere, in the contact bed, is often sufficient to defeat the operation of the bed. The idea that automatic devices require no attention is false. No plant, however automatic it may be, can be left without supervision.

LEONARD P. KINNICUTT.

The Stability of Effluents of Sewage Filters of Coarse Materials. BY H. W. CLARK. *Thirty-third Annual Report, Mass. State Board of Health*, pp. 373–393; *Eng. Record,* **46,** pp. 611–612. —The effluent from filters of coarse materials run at high rates

often contains a comparatively large amount of suspended organic matter, rendering the effluent very turbid and most unattractive in appearance. The series of experiments which are described in this paper confirm the results obtained in England and, as the author states, show that this suspended matter is different in character from that contained in crude sewage, is not at all easily acted upon by bacteria, is very much more stable, and under ordinary conditions will not take up free oxygen from the effluent or undergo subsequent putrefaction. The amount of organic matter determined as albuminoid ammonia and oxygen consumed in effluents from filters of coarse material is not a true index of the degree of purification of such an effluent, if we mean by purification, an effluent which will not putrefy when having free access to air. The Incubation Test, with the determination only of oxygen consumed is also not a sure guide, and a surer test by which to determine the liability of effluents to undergo secondary decomposition is the determination of the amount of dissolved oxygen present at the beginning and at the end of the period of incubation. LEONARD P. KINNICUTT.

The Vitality of Sewage Bacteria in Soil and the Antagonism of Soil Bacteria to the Typhoid Bacillus. BY G. C. WHIPPLE. *Eng. Record*, **46**, 440, 1902.—This paper is a review of Dr. Martin's paper on the "Nature of the Antagonism of the Soil to the Typhoid Bacillus," and of Dr. Houston's paper, "Inoculation of the Soil with Sewage." The general conclusion reached by Dr. Martin from his field and laboratory experiments was, that the typhoid bacillus was destroyed in unsterilized cultivated soil in less than twelve days. Dr. Houston concludes from the results of his investigations that "there is no indication that the addition of sewage to a soil leads to a marked or indeed to other than a temporary increase of the sewage microbes in general at the expense of the soil bacteria. On the contrary, the more hardy soil bacteria seemed to oust the more delicate sewage microbes in the struggle for existence." LEONARD P. KINNICUTT.

Air and Its Properties as Relative to Health. BY A. N. BELL. *Sanitarian, No. 398*, pp. 1–15 (1903).—The author gives in detail the composition of air as breathed and of respired air; states the various effects produced by the breathing of impure air, and gives the various opinions that are held as to the cause of these effects. The presence of the ammonia in the air, the author considers as the strongest indication of the presence of decomposable organic matter, and thinks that the condition known as "closeness" in a room may be caused by the decomposition of organic matter which is on the walls, furniture and hangings. Analyses are given at the conclusion of the paper showing the amount of carbon dioxide which is found in the air, if on the platforms, and in the air inside the cars running through the London tubes, as

showing what may be the condition of the air in the subways now being built in New York. The highest amount of carbon dioxide in the air on the platforms and in the air inside the cars occurs during the late afternoon hours, when it amounts to 11 parts and 20.46 parts, respectively, per 100,000 parts.

LEONARD P. KINNICUTT.

The Maignen Filters for the Preparation of Water for Sand Filtration. Condensed report of RUDOLPH HERING AND GEORGE W. FULLER. *Eng. Record*, **46**, pp. 484–485 (1902).—The Maignen system consists in using a device known as a scrubber, instead of a settling basin, for removing the finely divided suspended matter from a water, before applying the water to the surface of a sand filter. The scrubber is a filter containing at the bottom coarse grained material, such as broken stone, coke or slag, and at the top a layer of "elastic material" such as sponge or peaty fiber. The scrubbing consists of passing the water upwards through the filter at a very rapid rate, equal to 60,000,000 gallons per acre daily. The scrubbers are cleaned by occasionally reversing the flow of water through them and less frequently by removing the materials, cleaning and replacing them. "The available evidence indicates that the average removal of turpidity from the local river waters by settling basins (twenty-four hours capacity), and scrubbers would approximate about 30 and 65 per cent. respectively, and of bacteria, 40 and 80 per cent. respectively. As to the residual turbidity of the treated water, during all ordinary conditions in the river, it is estimated that it would be about 20 and 10 parts respectively. The probabilities are that a scrubber effluent is much more likely to average less than 10 parts than is a settling basin less than 20 parts. During muddy water the scrubber effluent would be about one-half as turbid as a settling basin effluent, should both be operated on a strictly physical basis. Should both receive special preparatory treatment, the results would be kept approximately within the general averages above stated." . . . "The final conclusions are that where settling reservoirs already exist, scrubbers will reduce the cost of operating the final filters, sufficiently to save their own total cost, in addition to the saving effected by the smaller area of the filters; and where settling reservoirs, are not yet built, scrubbers will effect a saving in addition to the saving effected by the smaller area of the filters." LEONARD P. KINNICUTT.

The Sea Mills Sewage Disposal Works Near Bristol, England. *Eng. Record*, **46**, p. 495 (1902).—Designed to accommodate a population of 10,000. It consists of a revolving screen, two grit chambers, three covered tanks, each 117 x 12 feet, and a covered storage tank capable of holding 600,000 imperial gallons. The discharge from this tank is into the tidal portion of the river Avon, and is regulated by a hydraulic penstock 36 inches in

diameter, worked automatically by a tidal clock, designed upon the alarm principle and so arranged that it actuates the penstock both for opening and closing, twice a day; the hydraulic accumulator containing sufficient water for four actions of the penstock. The plant is designed so that the treatment can be either chemical or bacterial. In the first case, the chemicals are added before the sewage enters the grit chambers and the three covered tanks act as settling basins; if the treatment is bacterial the covered tanks are used as septic tanks.

LEONARD P. KINNICUTT.

Sewage Disposal at Shelby, Ohio. BY BENJAMIN H. FLYNN. *Eng. News*, 48, pp. 434–435 (1902).—The plant consists of two sludge pits, each 10 x 24 x 6 feet deep; capacity 8,000 gallons, a settling basin nearly half an acre in area, dug in clay, the bottom and sides unprotected, and two intermittent filtration beds, with areas of 12,500 and 10,500 square feet respectively. These filters are underdrained every 30 feet with 6 inch drains; over these underdrains the filter beds are 2 feet deep, sloping to 18 inches midway between the drains. The main filling material is bituminous coal cinder. The volume of sewage treated is from 200,000 to 300,000 gallons a day, and is a weak domestic sewage. The sludge pits act as septic tanks, though not designed for that purpose, and remove about 50 per cent. of the organic matter, without producing much sludge, having been cleaned out but once in a year. The peculiar feature of the plant is the large settling basin into which the effluent from the sludge pits runs, before it is carried onto the intermittent filtration beds. No odor is given off from this basin. The analyses given are curious, in apparently showing that nitrates are formed by septic action, also in showing that the amount of purification calculated from oxygen consumed, is very different from the amount when calculated from the albuminoid ammonia. LEONARD P. KINNICUTT.

INDUSTRIAL CHEMISTRY.

Burning Coal Dust without Smoke. *Iron Age*, November 6, 1902.—Describes the Bartlett and Snow Co's. device for crushing and burning the dust. The coal is thoroughly dried before using, and these three paramount rules are given as the necessaries for complete combustion: (1) The coal must be of uniform size. (2) The coals used in the furnace must be of equal mixture, to admit of uniform combustion, and it is best that it be thoroughly dry. The plan of wetting coal before use, or putting a steam jet under a boiler fire, is a fallacy. (3) The dust must be burned in suspension, to get perfect combustion. To fulfil these objects, they crush the coal to uniform size, dry it down to 2 per cent. of moisture, pulverize to 80 mesh, and feed by a warm or spiral conveyor

into a fan blast. Air jets spray the dust upwards against the arch of the fireplace. In a test, 2.2 pounds of slack were used as dust, per horse-power-hour, against 2.85 pounds of ordinary coal fed by shoveling. J. W. RICHARDS.

The Development of the Modern By-Product Coke Oven in America. BY C. G. ATWATER. *Eng. Min. J.*, November 1, 1902. (Paper read before *Am. Inst. Min. Eng.*)—There are now 3,413 by-product ovens in the United States and Canada, capable of producing 3,000,000 tons of coke yearly, or 13 per cent. of the total production. The original Otto-Hoffmann type with vertical regenerators has been improved by automatic methods of handling the coal and coke, use of electrically-operated labor saving devices, and details of construction; at Sydney, soft coal has been compressed, producing improved coke; at Everett and some other plants, the gases are divided, in order to obtain high-power illuminating gas. The Schniewind type of oven uses the under-fired principles, and the regenerative chamber is entirely separated from the oven-supporting structure. Other improvements are the protection of the iron construction work from the radiated heat, the mechanical dressing of the brick oven walls, and the use of construction sheds provided with traveling cranes.

J. W. RICHARDS.

Electrochemistry at Sault Sainte Marie. BY J. W. RICHARDS. *Elec. Chem. Ind.*, November, 1902.—A description of the power stations at this point, and of the single electrochemical industry here installed, that of the Canadian Electrolytic Alkali Co., using the Rhodin process. The plant consists of three 200 kilowatt dynamos, each running 40 cells in series, and sending 900 amperes through each. The cell is of the mercury type, the salt solution being inside a bell, while the caustic soda forms outside the bell, in an iron pan. The amalgam discharges itself, by contact with the iron pan. The whole plant can make 6.5 tons of bleaching-powder, and 2 tons of caustic soda daily; the former would supply the whole Canadian market.

J. W. RICHARDS.

The Thallium Storage Cell. BY A. L. MARSH. *Elec. Chem. Ind.*, November, 1902.—A discussion of the peculiar advantages which thallium and its oxides present for this purpose, which might be practicable if the metal were cheaper. It costs now $6 per pound. Thallous oxide (Tl_2O) is soluble in water, while thallic oxide (Tl_2O_3) is insoluble in water and in caustic potash. If a solution of the former is electrolyzed, with sheet-iron electrodes, spongy thallium separates on the cathode and thallic oxide on the anode. When the current is stopped, the cell acts as an accumulator, the two deposits going back into the solution, and giving a potential of a little over 0.5 volt. It is hardly possible

that a commercial cell can be thus constructed, but the cell is very interesting scientifically. J. W. RICHARDS.

AGRICULTURAL CHEMISTRY.

A Study of Some of the Salts Formed by Casein and Paracasein with Acids—Their Relations to American Cheddar Cheese. BY L. L. VAN SLYKE AND E. B. HART. *N. Y. State Agr. Expt. Sta. Bull. No. 214*, pp. 53–79.—The relation of acids to the changes taking place in cheese curd was investigated. In extracting cheese with a dilute solution of sodium chloride a body was obtained which resembled in both physical and chemical properties that prepared by treating paracaseïn with dilute lactic acid. This salt-soluble product was always present in normal cheese, the quantity varying apparently with the amount of acid. It was found that both paracaseïn and caseïn combine with a number of acids to form unsaturated or mono-acid salts and saturated or di-acid salts. "The unsaturated salts formed by caseïn and paracaseïn with acids are soluble in dilute solutions of sodium chloride and in 50 per cent. hot alcohol, but insoluble in water. The saturated salts are practically insoluble in water, dilute salt solutions, and 50 per cent. hot alcohol. Both forms are sparingly soluble in dilute solutions of calcium lactate and calcium carbonate." The important changes taking place in the curd are considered due to the formation of the unsaturated paracaseïn lactate, with which product the ripening process begins, and not with paracaseïn as has been universally held. "The first step in the normal ripening process of American Cheddar cheese is probably a peptic digestion of unsaturated paracaseïn lactate." H. W. LAWSON.

Some of the Compounds Present in American Cheddar Cheese. BY L. L. VAN SLYKE AND E. B. HART. *N. Y. State Agr. Expt. Sta. Bull. No. 219*, pp. 203–216.—In studying the changes which take place in cheese during the ripening process, the authors found lysatine, histidine, and lysine in cheese four and one-half months old, and putrescine and lysine in cheese fifteen months old. Paranucleïn was present in all the cheeses examined. The studies indicate that there is normally in the ripening of hard cheese a conversion of primary into secondary amido compounds, to which may be attributed the gradual development of flavor. The methods used in the separation of the different compounds are given. H. W. LAWSON.

A Milk Unusually Rich in Solids. BY M. H. PINGREE. *Pa. Agr. Expt. Sta. Rep.*, 1901, pp. 192–194.—The milk of a healthy Guernsey cow four years old, and in her second lactation period, was found to contain on an average for two months, 5.8 per cent. of fat. Two samples taken about a month apart, soon after the

above record was obtained, showed the following percentage composition: Moisture 82.99 and 84.28, total solids 17.01 and 15.72, fat 6.40 and 5.90, caseïn and albumin 4.37 and 3.80, lactose 5.25 and 5.34, and ash 0.99 and 0.72, specific gravity at 60° F. 1.0372 and 1.035. The normal condition of the milk was considered as established by the relation of the different constituents.

H. W. LAWSON.

Study of Methods of Cattle Food Analysis. BY C. A. BROWNE, JR., AND C. P. BEISTLE. *Pa. Agr. Expt. Sta. Rep.*, 1901, pp. 117–122.—Duplicate determinations were made of the moisture, starch, pentosan, and galactan, in wheat, bran, and clover seed. The methods employed were, with some modifications, those of the Association of Official Agricultural Chemists for which the work was done, the object being to compare the results obtained by different analysts. H. W. LAWSON.

The Nature, Determination, and Distribution of the Pentosans in the Sea Island Cotton. BY F. S. SHIVER. *S. C. Agr. Expt. Sta. Bull. No. 78.* 38 pp.—The author reviews the literature of pentosans and their estimation and gives determinations by both the phenylhydrazine and phloroglucinol methods, of pentosans in the lint, seed, kernels, hulls, bolls, leaves, stems, and roots of the finest and coarsest varieties of Sea Island cotton of the crops of 1896 and 1898. The results are given in detail and discussed at some length. The whole plant showed an average pentosan content of 13.54 per cent. and the meal 12.92 per cent. The percentage varied in the different parts from 1.53 in the lint to 21.88 in the hulls. H. W. LAWSON.

The Analytical Methods for Carbohydrates as Applied to Foods and Feeding-Stuffs. BY W. H KRUG. *J. Frank. Inst.*, 154, 349–366, 401–422.—The general principles involved in the determination of sugars, starch, pentosans, and galactan are discussed, and special methods of analysis are described with particular reference to the detection of adulteration in meats and meat products, milk and milk products, flour and breadstuffs, sugars, fruit products, confectionery, beer, malt extracts, wines, distilled liquors, coffee, cocoa, spices, and condiments.

H. W. LAWSON.

Observations on the Production of Vinegar in Cellars. BY W. B. ALWOOD AND R. J. DAVIDSON. *Va. Agr. Expt. Sta. Bull. No. 127*, pp. 63–71.—Several barrels of cider were stored in an ordinary cellar and sampled and analyzed at frequent intervals. The maximum content of alcohol was reached in from 18 to 44 days after pressing. The acetic acid reached 3.5 per cent. in from 350 to 418 days. In laboratory experiments, no acetic acid was formed during alcoholic fermentation. The bulletin is made up

mainly of analytical data and is issued, as were two previous bulletins of the station, as preliminary to a more extended study of vinegar production. H. W. LAWSON.

Effect of Different Systems of Manuring upon the Amount and Quality of the Humus in the Soil. BY W. FREAR AND E. H. HESS. *Pa. Agr. Expt. Sta. Rep.*, 1901, pp. 173–186.—Further studies of the humus in soils which had received different fertilizer applications for a long series of years are reported. Biennial applications for nearly twenty years of barnyard manure containing about 534 pounds of nitrogen, resulted in an excess of 522 pounds of nitrogen per acre in the soil over that in unfertilized soil similarly treated in other respects. The use of lime decreased the amount of residual nitrogen. The application of complete mineral fertilizers containing 684 pounds of nitrogen resulted in an increase of only 260 pounds of nitrogen.
H. W. LAWSON.

Soil Analyses. BY W. FREAR AND C. P. BEISTLE. *Pa. Agr. Expt. Sta. Rep.*, 1901, pp. 137–172.—The article contains analyses of manured and unmanured tobacco soils in Cuba and an analysis of a mica schist soil in Pennsylvania. The results with the unmanured Cuban soils have been reported by the authors in an abridged form in this Journal, **25**, 5. The soils to which composted stable manure had been applied liberally, showed a lower specific gravity, more humus, and much greater quantities of lime and citrate-soluble potash and phosphoric acid.
H. W. LAWSON.

Limestones. BY W. FREAR. *Pa. Agr. Expt. Sta. Rep.*, 1901, pp. 187–191.—This gives descriptions and analyses of 42 samples of limestone. H. W. LAWSON.

Nitrogen-Fixing Bacteria. BY J. G. LIPMAN. *Pop. Sci. Monthly*, **62**, 137–144.—The author discusses the source of nitrogen as plant food, nitrification and denitrification in soils, and the fixation of atmospheric nitrogen by root tubercles and by soil bacteria independent of leguminous plants. H. W. LAWSON.

The Standardization of Sulphuric Acid. BY F. S. SHIVER. *S. C. Agr. Expt. Sta. Bull. No. 77.* 7 pp.—Methods for the standardization of sulphuric acid were compared, the results showing, according to the author, that the ammonium sulphate method is fully as accurate and far more simple and rapid than the barium chloride method, and that the two indirect methods proposed by Sorensen, in which sodium oxalate and sodium bicarbonate, respectively, are used give results which are too low.
H. W. LAWSON.

PATENTS.

AUGUST 5, 1902.

706,018. Jurgen Callsen, Elberfeld, Germany. Assignor to Farbenfabriken, of Elberfeld Co., New York, N. Y. **Alkyloxymethyl ester of salicylic acid.** Halogen methyl alkyl ethers are caused to react on salts of salicylic acid, for example, sodium salicylate with monochlorodimethyl ether, and separating the resulting ester, which is a colorless liquid soluble in ether, alcohol, chloroform and benzene, the alcoholic solution being colored violet by ferric chloride, and adapted for a medicine.

706,075. Hans Lubberger, Frankfort-on-Main, Germany. Assignor to Ludwig Wilhelm Gans, same place. **Clarifying liquids.** Adds gelatin and an oxidizing agent as potassium permanganate then heats.

706,089. Samuel McDonald, Youngstown, Ohio. **Basic Bessemer steel.** Pours successive converter charges into a common receptacle, from which the metal is taken to be cast, testing each charge in turn and varying the duration of each succeeding blow according to the result of the preceding one.

706,119. James C., Willie J., and Robert E. Shaw, Bessemer, Ala. **Paint.** Asphalt varnish 2, coal tar 36, creosote 8, linseed oil 2, and fine salt 1 gallon.

706,138. Edwin K. Welch, Philadelphia, Pa. **Mortar.** Ground unslaked lime 25, ground cinder 60, jute 10, and litharge 5 per cent.

706,280. Francis H. Thibodo and Sebastian S. Peckinpaugh, Green Bay, Wis. **Etching surfaces.** Covers one side of a sheet of glass with a mixture of ammonium bichromate 1.3, chrome alum 0.03, ammonia 0.5, albumin 30, water 100, drying in subdued light, exposing to light, then pressing sensitized and exposed carbon tissue on this coating, and developing, then eroding the surface of the plate by hydrofluoric gas, where the light has not acted on the carbon tissue, and finally removing the rest of the coating.

706,302-3. Both to Levi R. Darling, Providence, R. I. **Extracting precious metals.** Spreads a thin layer of pulverized ore over a large surface provided with suitable drains, and covers it with a cyanide solution, then passes a heavy roller back and forth over the mixture till most of the liquid goes into the drains that lead to a common sump, and then precipitating the metal, as gold.

706,354. Samuel L. Summers, Philadelphia, Pa. **Methylene disalicylic acid.** Boils a saturated solution of salicylic acid with successive portions of hydrochloric acid and formaldehyde, and removes excess of reagents from the precipitate by repeated wash-

ing in boiling water. A tasteless, impalpable creamy white powder, melting at 245° C., insoluble in water or benzene, soluble in ether and cold ethyl alcohol.

706,355. Samuel L. Summers, Philadelphia, Pa. **Acet-salicyl phenetidine.** Heats 1 molecule acet-paraphenetidine with 1 molecule bromsalicylic acid to about 140° C., and extracts the white satin-like crystals by a solvent, as ether, alcohol or benzene.

706,356. As above. Same salt with formula $C_{17}H_{17}NO_4$ instead of $C_{17}H_{17}NO_5$. Made by acting on salicylic acid with phosphorus oxychloride and paraphenetidine at 100° C., extracts with acetic anhydride and purifies by recrystallization.

706,365. Sidney Trivick, Clapham Common, England. Treatment of **gold and silver ores.** Mixes solutions of calcium hypochlorite and ferric chloride with the ores, the mixture evolving nascent chlorine.

706,411. Adolf Heinamann, Eberswalde, Germany. Extracting **ellagic** acid. Concentrates an aqueous extract of crude tanning materials, to a specific gravity of 1.2, separating the crude, crystalline, insoluble ellagic acid, then boils the extracted material with a suitable acid, filters off the acid and separates the ellagic acid set free by the inversion from the residue.

706,444. Carl T. J. Opperman, London, England. **Composition for secondary batteries.** A paste of oxide of lead 100, bitumen in benzine 6, and dilute sulphuric acid sufficient to form an easily worked paste.

706,472. Alfred E. Johnson, Colorado Springs, Colo. **Filter bed for chlorination barrels.** A filter in a chlorination barrel of bars arranged side by side and having their sides grooved or hollowed out, and filtering material filling the space between the bars, and further secured by binding strips.

706,475. Eduard Pohl, Weiswasser, Germany. **Dividing metals finely.** Sprays the melted metal into a retort heated to a suitable temperature, evaporates the spray and condenses the vapor, whereby a fine tin powder is got.

AUGUST 12, 1902.

706,532. George M. Dallas, Chicago, Ill. Assignor one-half to Wm. R. Chittenden, same place. **Artificial fuel.** Heats coal dust or culm to ignition point, and mixes 25 tons with paraffin residuum 50, and water 30 gallons, crude potash 5, borax 10, acetic acid 3, antimony 25, and clay 200 all in pounds, oil cake meal 1 peck.

706,553. Charles M. Hall, Niagara Falls, N. Y. **Making alumina.** Heats bauxite with a reducing agent by an electric current without fusion, whereby the contained impurities are reduced in whole or in part, then fusing and agglomerating the impurities. A core of bauxite is surrounded with a mixture of

bauxite and carbon, the core is removed, when the surrounding mass is reduced and fused to remove impurities.

706,631. Edward L. Anderson, St. Louis, Mo. Assignor to John A. Gilliam, same place. **Chemical cell.** Contains an aluminum electrode, a negative electrode of carbon, and an electrolyte of calcium fluoride, zinc chloride, and nitric acid.

706,760. Wm. R. Knox, Newark, N. J. **Hydraulic fire-proof cement.** Lime 60, silica 24, alumina 6.5, magnesia 5, muriatic acid 3, iron oxide 1.5 per cent.

706,784. Ralph C. Robinson, Boston, Mass. Assignor to John Irving, Newton, Mass. **Chemical testing apparatus for albumen.** A vessel having supporting notches or pockets, combined with a testing blade having lugs to engage said pockets and support the blade which has an inlet, an outlet near the lower end of the blade, a passage way extending longitudinally of the blade and connecting the inlet and outlet, the body of the blade showing a dark color on one of its faces against which the precipitate is seen.

706,790. August Wolpers, Haemalerwald, Germany. **Cleaning paste.** Cooks soap 12, and milk 10 decigrams to a paste, then adds 2 eggs, and stirs till cold.

706,907. Wm. E. Dempster, Brunswick, Ga. **Paint oil.** Mixes low grade rosin 4, and kerosene 1 part, and boils the mixture in the open air.

706,921. Moritz von Gallois, Hoechst-on-Main, Germany. Assignor to Farbwerke, vorm. Meister Lucius und Brüning, same place. **Bromindigo.** Reacts with bromine on indigo-white in molecular proportions, and oxidizes the bromindigo-white to bromindigo.

706,961. John F. Krebs, Colorado Springs, Colo. Assignor one-half to Constantine Casser, same place. **Paint oil.** Consists of marine (whale) oil 2000, zinc sulphate 10, litharge 15, manganese dioxide and sugar of lead each 5, chloride of lime 100 all pounds, acetic acid 35, benzine and turpentine 5 each, and linseed oil 10 gallons.

706,967. Max Lehmann, Berlin, Germany. **Laundry polish.** Talc 60, carnauba wax 10, beeswax 10, and perfume to suit.

709,969. Ivan Levinstein and Carl Mensching, Manchester, England. **Black sulphur dye.** A nitro derivative of phenol disazobenzene is heated with *p*-oxydinitrodiphenylamine, sulphur and an alkaline sulphide. Insoluble in alcohol and strong sulphuric acid, soluble in caustic lye and sodium sulphide with a greenish blue shade, dyeing unmordanted cotton deep green-black.

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707,080. Charles M. Bowman, Lebanon, Pa. Assignor to

Diamond Match Co., New York, N. Y. **Match,** carrying a portion having oil of horsemint, to repel rats and mice.

707,107. John Herman, Cañon City, Colo. **Treating ores.** Roasts copper sulphides at low heat to make copper sulphate and some iron sulphate, including ferrous sulphate in large proportion, then leaching and precipitating the metallic copper and adding salt to the leaching solution before or after leaching, whereby the ferrous salts are made chlorides, and a solution with excess of salt is obtained adapted to dissolve copper and silver out of carbonate and oxide ores.

707,110. Fritz Hofmann and Jurgen Callsen, Elberfeld, Germany. Assignors to Elberfeld Co., New York, N. Y. **Glycolic menthyl ester.** White, lustrous needles melting at 87° C., sparingly soluble in water, readily soluble in most organic solvents, being split up into menthol and glycolic acid when reacted on by caustic alkalies or alkaline carbonates, and used as a medicine.

707,113. George H. Hughes, London, England. **Cattle food,** of sugar-cane pith 20 per cent., and molasses 80 per cent.

707,129. Jean Lowenthal, Magdeburg, Germany. Assignor to Quarzitol Co., New York, N. Y. **Artificial stone.** Quartz sand 85, pulverized quartz 4, alunite 0.5 magnesia 1, borax 2, mineral colors 2, mineral oil 3, and water 2 parts by weight.

707,178. Samual L. Summers, Philadelphia, Pa. **Methylene diacetodisalicylic acid.** Microscopic crystals, tasteless, melts at 145° C., insoluble in water but soluble in ether and alcohol, made by reacting with acetic anhydride on methylene diacetodisalicylic acid under heat and pressure.

707,214. Wm. F. Downs, Jersey City, N. J. **Treating rebellious ores of the precious metals.** Mixes the pulverized and roasted ore with a sodium compound and carbon to briquettes, heats till sodium is liberated, removes the sodium compounds and impurities, and recovers the gold.

707,224. Tomasso Giussani, Milan, Italy. **Preserving wood.** Immerses it first in anthracene and pitch at over 100° C., then in a mixture of zinc chloride and creosote, the first coating being forced into the wood by the second.

707,270. Karl Stephan, Berlin, Germany. Assignor to Chemische Fabrik auf Actien, vorm. E. Schering, same place. **Making camphene.** Heats halogen compounds of pinene with bases of the aliphatic group, binds the excess of base by an acid and isolates the camphene by distillation with steam.

707,271. Karl Stephan, Berlin, Germany. Assignor to Chemische Fabrik auf Actien, vorm. E. Schering, same place. **Camphene.** Process of reacting with ammonia on hydrogen haloid compounds of pinene for a long time at 210° C.

707,278. Samuel L. Summers, Philadelphia, Pa. **Camphoric acid ester of methylene diguaiacol.** A stable crystalline compound of camphoric acid and diguaiacol methane, tasteless, white, lustrous scales, melting at 130° C., insoluble in dilute alkalies and soluble in ether, benzene and hot ethyl alcohol. Obtained by passing hot formaldehyde gas through a hot solution of camphoric acid, guaiacol and phosphorus oxychloride in xylene.

707,373. Oscar Bally, Mannheim, Germany. Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. **Anthracene dye.** Condenses halogenized amino-anthraquinone substances with the sulpho acids of primary aromatic amines, and sulphonates the product. Water solution blue-green to violet, in concentrated sulphuric acid alone, reddish to violet and with boric acid green to violet.

707,374. Same as above except that **nitro anthraquinone** substances are used. Solutions yellow-brown to violet, soluble in glacial acetic acid red to orange.

707,402. Heinrich Dreser and Jurgen Callsen, Elberfeld, Germany. Assignors to Farbenfabriken of Elberfeld Co., New York, N. Y. **Atropinium alkyl nitrate,**

$$\left.\begin{matrix} C_6H_5 \\ HO-CH_2 \end{matrix}\right\rangle CH-CO-O-C_7H_{11}=N\begin{matrix} \diagup CH_3 \\ -CH_3, \\ \diagdown NO_3 \end{matrix}$$

is a white crystalline body melting at 163° to 164° C., readily soluble in water and alcohol, difficultly soluble in ether, acetone and chloroform, and useful as a medicine.

707,403. Arthur Eichengruen, Elberfeld, Germany. Assignor to Farbenfabriken of Elberfeld Co., New York, N. Y. **Photographic developer.** A reducing agent as pyrogallol, an alkali as potassium carbonate, and acetone alkali bisulphite.

707,423. Adolph Jolles, Vienna, Austria-Hungary. Obtaining **albuminous substances.** Adds sulphurous acid to a magma of blood corpuscles to destroy oxidases, treats with ammonia, oxidizes the mixture by hydrogen peroxide, boils and precipitates albumen.

707,434. Joseph Lones, Smethwick, England. Assignor two-thirds to Jabez Lones and Edward Holden, same place. **Making pigments.** Heats zinc ore to crude zinc oxide, dissolves this in strong hot acetic acid, adds sheet zinc to precipitate lead, crystallizes out zinc acetate and dissolves it in water, precipitates zinc sulphide by hydrogen sulphide and heats with free sulphur out of contact with air to white pigment.

707,470. Joseph C. Webster, Philadelphia, Pa. **Solder for aluminum.** Tin and lead 5 each, aluminum 4 to 6, and zinc 1 part.

707,493. Ugo Alvisi, Rome, Italy. **Detonating compound.** Ammonium perchlorate, 17.20 per cent., mercuric fulminate, 83.80 per cent.

707,506. Erminio Ferraris, Monteponi, Italy. Treating **sulphide ores.** Adds 2 molecules of concentrated sulphuric acid to each molecule of the metallic sulphides in the ore, especially zinc, and without the aid of heat, producing soluble zinc sulphate.

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707,550. George H. Chinnock, Brooklyn, N. Y. **Self-healing material.** Caoutchouc 70, wax 9, resinous gum as camphor 10, and oil 10 per cent., a pasty mass between layers of rubber for use in mending pneumatic tires.

707,551. Guilliam H. Clamer, Philadelphia, Pa. **Eliminating metals** from mixtures thereof. Fuses an alloy of copper, etc., known as brass scrap with a flux of silica, soda-ash and a metallic compound as lead whose base is to unite with the alloy and of which the heat of formation is less than that of the part of the alloy eliminated so that the base enters the alloy and a part of the latter as zinc goes into the slag.

707,566. Eugene R. Edson, Cleveland, Ohio. **Rendering fish,** etc. Heats the material in a closed vessel under pressure gradually increased till the mass begins to cake so as to retard the flow of liquid, and maintaining this pressure while blowing air or gas into the mass to keep it porous.

707,638. Dexter Reynolds, Albany, N. Y. Making **steel direct from ore.** Mixes granulated iron oxide with granulated carbon enough to deoxidize it, puts the mixture in a closed furnace and heats it by a neutral flame till the iron oxide is deoxidized and the iron carbonized, then adding granulated fluxes to remove impurities and fusing the metal and finally separating the slag, all in one furnace.

707,646. Walter T. Scheele, Catonsville, Md. Assignor two-thirds to Hermann Knollenberg and Wm. F. Assau, Baltimore, Md. **Soup preparation.** Mixes minced meat, flour, water, and yeast to a paste, warms, ferments and dries.

707,654. James Thame, London, England. Assignor to South-western Rubber Co., same place. **Treating crude rubber.** Soaks the rubber in a hot alkaline solution in a closed vessel, then washes in water to remove dissolved impurities.

707,670. Sylvester Zuckschwerdt, Stassfurt, Germany. **Refractory bricks.** Soaks bricks in solution of magnesium chloride, then bakes them to dissolve the salts and liberate hydrochloric acid.

707,677. Fredrick H. Crass, Murfreesboro, Tenn. **Making paint.** Carbonizes and pulverizes raw cotton and then mixes it with coal-tar, as say one pound to one gallon.

707,698. Frederick A. Hurd, Cookshire, Canada. Assignor to Charles C. B. Bailey, same place. **Making cheese.** Mixes sour cream buttermilk with fresh sweet milk to precipitate curd, drains the curd and exposes to air till flavor develops, presses slightly, dries, disintegrates and represses for market.

707,722. James H Ricker, Fort Worth, Texas. Assignor two-thirds to Samuel P. Green and John A. T. Evans, same place. **Fuel compound.** Crude petroleum 18, rosin 2, sawdust and clay 12 each, and liquid glass 2, and coal dust or lignite 54 parts by volume well mixed.

707,747. Gerald F. Weathermann and George Holzhausen, Enfield, England. **Photo-mechanical printing plate.** Coats stone, etc., with a solution of silicate of potash and tannin in beer, dries and primes with dilute glue, and sensitizes with full strength chrome gelatin.

707,752. Victor E. Belledin, Paris, France. **Flexible elastic material,** not easily punctured. Hides are cleaned, dehaired, and soaked in cold crude petroleum, then in a mineral or fatty oil, and dried, then in an alkaline silicate, cut and shaped, soaked in benzene and afterwards in chloride of lime solution, dried and put in a benzene solution of cauotchouc.

707,788. John Murphy, Columbus, Ohio. **Cement.** Crushed hard iron slag 50, powdered high-limed cinders 30, Portland cement 14, soluble silicate 2, and water 4 parts.

707,812. Fritz Ach, Mannheim, Germany. Assignor to C. F. Boehringer Sohne, Waldhof, near Mannheim, Germany. **Alkoxycaffein.** Heats chlorocaffeïn under pressure, with phosphorus pentachloride and phosphorus oxychloride, evaporates and boils the residue with methyl alcohol in a reflux. 3^1-methoxy-8-chlorocaffeïn crystallizing in fine shining felted needles, melting at 129° to 130° C., soluble in boiling water, hot alcohol, benzene, acetone, acetic ether, chloroform, and hydrochloric acid gives a strong murexid reaction with dilute nitric acid or chlorine water.

707,813. Fritz Ach, Mannheim, Germany. Assignor to C. F. Boehringer Sohne, same place. **Triphenyl methane dye.** Heats an aminophenyl tartronic acid with ethylbenzyl aniline, hydrochloric acid and ferric chloride. Forms dimethyl-diethyl-dibenyzl-triamino-triphenyl carbinol, crystalline, becoming resinous on exposure to air, insoluble in water but readily soluble in alcohol, light gray, darkening on exposure and forming, with feebly fuming sulphuric acid at 100° C., a violet dye.

707,832. Chas. de la Harpe, Basle, Switzerland. Assignor to Dye Works, formerly Durand, Huguenin Co., same place. **Blue dye.** Reacts with sulphurous acid on a sulphonic gallocyanine from nitrosoethylbenzylaniline sulphonic acid. Soluble pale blue in sodium acetate and reddish in concentrated sulphuric acid, turning to blue by oxidation. WM. H. SEAMAN.

REVIEW OF AMERICAN CHEMICAL RESEARCH.

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WILLIAM A. NOYES, Editor.

MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

Etching of Quartz in the Interior of Conglomerates. BY MYRON L. FULLER. *J. Geol.*, 10, 815–821.—The author discusses in the light of his own observations at Blossburg, Pa., the cause of the frequently observed etching of quartz pebbles on the surface of highly silicious conglomerates of the coal-measure and elsewhere. For that locality, at least, the conclusions are: That the etching did not take place under existing conditions of exposure to the atmosphere and to soil humus; that it is an internal feature, which took place while the conglomerates were somewhat deeply buried and fully consolidated, since it is confined to the immediate walls of the bedding or other planes; that the active solvent was an organic acid, most likely derived from vegetable remains within the rock. C. W. Hayes had earlier ascribed similar etchings to the action of organic acids under ordinary atmospheric conditions (*Bull. Geol. Soc. Am.*, Vol. 8, 213). W. F. HILLEBRAND.

The Franceville (El Paso County, Colorado) Meteorite. BY H. L. PRESTON. *J. Geol.*, 10, 852–857, 3 figures.—This siderite, found about 1890, weighs 18.3 kilos and its dimensions are $21 \times 23 \times 5.5$ cm. It is pitted on all sides. But a single nodule of troilite of any size was found on slicing the mass. Etch-figures are very pronounced, sharp, and clear, and the etched surfaces show under the microscope no schreibersite whatsoever. Mr. John M. Davison reports the following analysis. Soluble in HCl: kamacite and taenite, 99.16; combined carbon not determined. Undissolved in HCl; schreibersite, 0.837; graphite and trace of silicates, 0.003; platinum from 23.9 grams, trace. The kamacite and taenite together gave Fe, 91.92; Ni, 8.13; total, 100.05. Specific gravity, 7.87.

W. F. HILLEBRAND.

The Mineralogy of the Chicago Area. BY ALJA ROBINSON COOK. *The Chicago Academy of Sciences, Bull. No. 5 of the Nat. Hist. Survey*, 57 pages, plates.—Over fifty species are noted, including the rock-forming minerals. W. F. HILLEBRAND.

Report of the State Board of Geological Survey of Michigan for the Year 1901. 304 pages, maps and plates.—In the various contributions by Alfred C. Lane, state geologist, and other writers, making up this volume, are to be found many analyses, in part new, in part old, of limestones, dolomites, marls, clays, etc. W. F. HILLEBRAND.

Native Arsenic from Montreal. BY NEVIL NORTON EVANS. *Am. J. Sci.*, **15**, 92–93.—This is a more detailed description of the occurrence than was first given in the same Journal, **14**, 397 (see also this Journal, **25**, R. 11). The mineral occurs as concentric lumps united into a reniform structure and occupying portions of a vein cutting nepheline syenite. It is characterized by its purity, as shown by the analysis: As, 98.14; Sb, 1.65; S, 0.16; insoluble, 0.15. No silver, bismuth, or other element was found. W. F. HILLEBRAND.

Note on the Condition of Platinum in the Nickel-Copper Ores from Sudbury. BY CHAS. W. DICKSON. *Am. J. Sci.*, **15**, 137–139.—A number of samples of ore from different localities were examined with negative results, but one from the Victoria mine, about twenty miles west of Sudbury, consisting of massive and almost pure chalcopyrite, yielded, after treatment successively with hot nitric acid, carbon disulphide, and sulphuric and hydrofluoric acids, a final residue of numerous small brilliant tin-white crystals and fragments resembling sperrylite and giving tests which left no doubt of their identity with that mineral. Additional proof was afforded by angle measurements. There is thus obtained further evidence to support the opinion that the platinum in copper-nickel ores exists, in part at least, as the arsenide, and that it is associated with the copper rather than with the nickel. W. F. HILLEBRAND.

Water Storage on Salt River, Arizona. BY AUSTIN POWELL DAVIS. *U. S. Geol. Survey, Water Supply and Irrigation Paper No. 73*, 54 pp., maps and illustrations.—Near the close of this report the question of locally available material for the manufacture of cement for use in the construction of dams is considered. There are given partial analyses by E. A. Duryee, of Colton, California, of a limestone, two shales, and three clays, also of the cement made from the limestone and one of the clays. This limestone and clay were again analyzed in somewhat greater detail by Dr. E. T. Allen in the laboratory of the U. S. Geol. Survey. The tensile strengths of the cement under different conditions were also determined by Mr. Duryee with very gratifying results. W. F. HILLEBRAND.

The Mining Industry in North Carolina during 1901. BY JOSEPH HYDE PRATT. *North Carolina Geol. Survey, Economic Paper No. 6*, 102 pp.—This publication was issued to meet inquiries for information regarding the condition of the mining industry and the minerals that are being mined in the state. Quite a number of analyses are introduced without data as to the makers or whether the analyses are new or old.

W. F. HILLEBRAND.

The Minerals and Mineral Localities of Texas. BY FREDERIC W. SIMONDS. *Univ. of Texas Mineral Survey, Bull. No. 5*, December, 1902, 104 pp.—The arrangement is alphabetical, with numerous analyses, most of which first appeared elsewhere. There is also a list arranged by counties and a brief paper by Wm. B. Phillips on *The Commercial Aspects of Certain Ores in Trans-Pecos, Texas*, which contains the results of many assays, chiefly for gold and silver.

W. F. HILLEBRAND.

Problems Controlling the Geologic Deposition of the Hydrocarbons. BY GEORGE I. ADAMS. *Trans. Am. Inst. Min. Eng.* (*Advance extra, New York and Philadelphia Meeting, February and May, 1902*, 7 pp.).—The author argues that the accumulation of hydrocarbons in reservoirs through underground circulation may be intimately connected with the water with which they were in contact during their movement. Though water and the hydrocarbons are usually regarded as immiscible, it is urged that with varying conditions of temperature and pressure, a limited amount of solution of certain of the hydrocarbons may take place. This being so, the dissolved portions will partake of the movement of the waters circulating downwards under gravitative pressure, while the undissolved portions will rest upon the water and tend to seek a higher level against the downward water flow. In this way an originally homogeneous mixture of hydrocarbons might become, in time, more or less fractionated and removed. Were the configuration of the overlying impervious strata favorable, reservoirs of hydrocarbons might be formed at different and perhaps far distant points, and from the water solution under changing physical conditions the dissolved constituents might be liberated and in time fill other reservoirs or escape to the surface. It is suggested, too, as a result of Dr. D. T. Day's experiments in fractionating oil by filtering it through Fuller's earth, that the structure of the rocks in the course of underground circulation may be a cause of variation in composition. In the discussion following, Dr. D. T. Day expresses disbelief that water is a carrier of gaseous or liquid hydrocarbon suspended or mixed in it in any way, basing his lack of faith on certain experiments of his own which Mr. Adams in turn claims have no direct bearing on the problem.

W. F. HILLEBRAND.

A Consideration of Igneous Rocks and their Segregation or Differentiation as Related to the Occurrence of Ores. BY J. E. SPURR. *Trans. Am. Inst. Min. Eng.* (*Advance extra, New York and Philadelphia Meeting, February and May, 1902*, 53 pp.).—This is a paper well worthy of the mineral chemist's attention, of which only the more important conclusions can be outlined. After reviewing the relations of ore-deposits to igneous rocks in general, and the segregation or differentiation of the latter, evidence is presented to show that quartz veins are but the final result of magmatic segregation, and that gold quartz veins show, in the overwhelming number of instances, genetic connection with silicious igneous rocks, of the dioritic and granitic families. The statement is then formulated that "although gold is present in all igneous rocks, and may be unequally distributed in any of them, yet the conditions for concentration by magmatic segregation become more favorable in what has been shown to be the extreme silicious product of rock-differentiation—in quartz veins or dikes." By extended inquiries and reasoning, the author is led to the hypothesis that "by magmatic segregation the metals of commercial value, as well as the other rock-forming elements, are irregularly and to a certain extent independently concentrated in certain portions of the earth's crust. Such portions, characterized by the relative abundance of certain metals, may be called metalliferous provinces. . . . Moreover, within these metalliferous provinces (as is the case with the petrographic provinces) magmatic segregation produces sub-provinces, secondary, perhaps, in theoretical importance to the grander divisions, but of more practical importance to miners. . . . by magmatic segregation, the rarer metals (like the commoner elements again) are in many cases preferentially concentrated into certain rocks in a given sub-province. Finally, within these rocks the metals may be segregated chiefly into certain portions, even producing in the case of the common metals . . . workable ore-deposits without further concentration; and in the case of the less common ores, either directly producing workable deposits . . . or producing rocks relatively so rich that it requires only the concentrating action of other agents (chiefly circulating waters) to create ore bodies. It is the writer's belief that the origin of metal-producing districts, as contrasted with barren districts, is, in most cases, due primarily to magmatic segregation, and that an important class of ore bodies is due directly to this." Concentration of ores may be effected by other than this initial process of magmatic segregation, as the action of gases and liquids expelled from consolidating magmas, that of hot spring waters, and of cold surface waters penetrating underground or acting upon the surface, any one or several of which may be effective in a particular case. The author, in a postscript, regards his view as strengthened by Wagoner's paper (*Trans. Am. Inst. Min. Eng.*,

31, 798), showing the amounts and distribution of gold and silver in California rocks remote from mineral deposits.

W. F. HILLEBRAND.

Igneous Rocks and Circulating Waters as Factors in Ore-Deposition. BY J. F. KEMP. *Trans. Am. Inst. Min. Eng.* (*Advance extra, New Haven Meeting, October, 1902*, 16 pp.).—This is an additional and instructive contribution to the discussion that has appeared in the recent volumes of the *Transactions*. The author's chief aim is to show that in all probability much greater efficiency is attributed to the expulsive action of the normally heated earth's interior in promoting aqueous underground circulation than this agency deserves, and that igneous rocks are rather to be looked upon as the chief stimulators of deep-seated circulation. The influence of a molten mass of rock injected into strata permeated by meteoric waters must be an enormous factor in causing these waters to move toward the surface, and in so doing, to deposit the store of dissolved matter they bring from below. The author is inclined to think that with the complete cooling of the intrusive, the period of ore-deposition practically ceases, notwithstanding the arguments of Van Hise that this deposition is mainly due to the action of waters circulating under gravitative head.

W. F. HILLEBRAND.

Amarillium. BY WILLIAM M. COURTIS. *Trans. Am. Inst. Min. Eng.* (*Advance extra, New Haven Meeting, October, 1902*, 3 pp.).—In assaying a copper-carbonate ore from the Frazer claims, Similakameen, British Columbia, the author obtained a gold button, showing such a peculiar behavior on parting that he was led to examine large quantities of the ore, with the result that there was eventually isolated a substance which he thinks may be a new metal and calls amarillium. It is precipitated by hydrogen sulphide and is soluble in the alkaline sulphides. The work is crude and the evidence quite inconclusive as to the character of the material obtained. Eastern assayers had reported the metal in the ore to be platinum and palladium.

W. F. HILLEBRAND.

Minerals Observed on Buried Chinese Coins of the Seventh Century. BY AUSTIN F. ROGERS. *Am. Geologist*, 31, 43–46.—At Kiukiang was dug up a pot containing about 5,000 corroded copper coins, on many of which the inscriptions were still plain. The minerals coating the coins were: Cuprite, malachite, azurite, copper, and cerussite. The origin of the last is not clear, as the material of the coins is free from lead. Only rarely are all or even most of the minerals observed on the same coin. In the ase of cuprite, malachite, and azurite, the paragenesis is indiated by the order in which these names are here written. The ppearance of the minerals is briefly described and the paper

closes with a list of minerals found on coins with the names of observer, localities, and references to publication.

W. F. HILLEBRAND.

Apatite Crystals, Antwerp, New York. BY NICHOLAS KNIGHT. *Am. Geologist*, 31, 62.—An analysis by Frank L. Hann, of Cornell College, Iowa, is communicated without comment, showing: CaO, 48.20; P_2O_5, 41.00; SiO_2, 0.60; Al_2O_3, 9.00; CaF_2, 1.20. W. F. HILLEBRAND.

Geology of the Jemez-Albuquerque Region, New Mexico. BY ALBERT B. REAGAN. *Am. Geologist*, 31, 67–111, plates.—The region is destined, according to the author, to develop great mineral wealth. The only chemical matter in the paper consists of old analyses by Loew of mineral waters, of a soil, and of Rio Grande mud. W. F. HILLEBRAND.

Jade. BY S. E. EASTER. *Nat. Geographic Mag.*, 14, 9–17.—A paper devoid of chemical data. W. F. HILLEBRAND.

Notes on Southwestern Utah and Its Iron Ores. BY G. C. HEWETT. *Proc. Colorado Sci. Soc.*, 7, 56–66, map and plates.—The region covered by the St. George topographic sheet of the U. S. Geol. Survey, and occurrences of coal and iron therein, are described. A representative analysis of samples of coal (non-coking) taken from several beds shows: Water, 7.24; volatile combustible matter, 42.01; fixed carbon, 44.67; ash, 6.08; sulphur, mostly organic, 5.77. Eight samples of magnetite gave an average of 62.56 per cent. iron and a ratio of phosphorus to iron of 0.123 : 100. The limonites analyzed averaged 56.66 iron with the ratio of phosphorus to iron of 0.194 : 100.

W. F. HILLEBRAND.

Modern Methods of Rock and Mineral Analysis. BY W. F. HILLEBRAND. *J. Frank. Inst.*, 105, 109–126, 181–194.—An address delivered before the chemical section of the Franklin Institute in January, 1902. W. F. HILLEBRAND.

METALLURGICAL CHEMISTRY AND ASSAYING.

Coking in Bee-Hive Ovens with Reference to Yield. BY C. CATLETT. *Trans. Am. Inst. Min. Eng.*, 32 (1902).—The actual output of Connelsville ovens is about 60 per cent. of the weight of coal charged, whereas by careful management and intelligent burning, it can be raised 3 to 5 per cent. No coke should be burnt in an oven, but all saved. Any which is burnt, besides being so much dead loss, makes the resulting coke poorer by its ash being deposited in the pores of the coke. In some cases, enough coke is burnt to raise the ash 4 per cent. above what it should be. The principal thing affecting the yield is the care

and skill in admitting, excluding, or controlling the air needed by the oven. J. W. RICHARDS.

Origin of the Mesaba and Gobelic Iron Ores. BY K. LEITH. *Iron Age*, December 4, 1902 (paper read before L. Superior Mining Inst.).—Principally a discussion of the geology of the ranges, and the associated rocks and minerals. The conclusion confirms Irving and Van Hise's statements that the original rock of the formation was mainly hydrous ferrous silicate granules, which have been altered into iron carbonate by percolating waters, and thence into the oxide. J. W. RICHARDS.

Blast-Furnace Gas Engines and Their Work. BY D. REINHARDT. *Iron Age*, December 4, 11, 18, 25, 1902.—A translation of a long, well-illustrated article on the most successful types of gas engines. J. W. RICHARDS.

Colorado Fuel and Iron Company's Plants. *Iron and Mach. World*, December 13, 1902.—Illustrated description of the present condition of the large Minnequa Works, near Pueblo, a plant embodying the latest ideas in the manufacture of iron and steel.
J. W. RICHARDS.

The Electric Smelting of Iron Ore. BY A. J. ROSSI. *Iron Age*, December 25, 1902.—Continuation of a former article by same author. It is stated that 200 horse-power will produce a gross ton of pig iron per day in an electric furnace. If f is the price of fuel at the blast-furnace in dollars per gross ton, f' the cost at the electric furnace, p and p' the corresponding costs of iron ore at the two furnaces, K and K' the cost of limestone and labor per ton of iron produced, H the electric horse-power necessary to produce a ton of iron per day, and C the cost of that power in dollars per year, the author works out the cost of iron per ton to be, in dollars,
by the blast-furnace,

$$1.666\,p + f + \mathrm{K},$$

by the electric furnace,

$$1.666\,p' + 1.333 + 0.25 + f' + \frac{\mathrm{H} \times \mathrm{C}}{365} + \mathrm{K} + 2.50,$$

and the costs of the two will be equal when

$$0.00822\ \mathrm{HC} = 5(p - p') + 3(f - f') - 7.50.$$

If the first term is greater than the second, the electric process costs more; if less, the ordinary process. The author concludes that there are some localities in which the electric smelting is already the cheaper. J. W. RICHARDS.

Briquetting Iron Flue Dust. BY R. M. HALE. *Iron Age*, December 11, 1902.—The cardinal principles of briquetting are enumerated as (1) thorough amalgamation of the binding mate-

rials with the flue dust, (2) thorough pugging with pressure, (3) additional pressure after the material has been forced into moulds, and (4) slow but thorough drying. The article then describes in detail all these operations. The bond recommended is lime, salt and soda-ash, boiled to a pasty consistency. Lime alone does not give sufficient hardness. Waste gases from hot-blast ovens are used for drying, the end temperature being 200°.

J. W. RICHARDS.

Slag Constitution: Studied by the Tri-Axial Diagram with Rectangular Co-ordinates. BY H. E. ASHLEY. *Trans. Am. Inst. Min. Eng.*, 31, 855.—Author shows that a tri-axial diagram with co-ordinates at 60° is not an absolute necessity for plotting three constituents of a compound, whose sum is a constant, say 100 per cent. If a line is drawn from 100 on the axis of abscissas to 100 on the axis of ordinates, then, for any point within this right-angled triangle its abscissa may represent one constituent, its ordinate another, and its vertical distance from the hypothenuse will represent the third, all constituents on the same scale. Further, just as vertical lines will represent constant abscissas, and horizontal lines constant ordinates, so lines parallel to the hypothenuse represent constant quantities of the third constituent represented. The author then plots in this new way the results of Professor Hofman on iron calcium silicates, and deduces from his discussion that all such silicates contain $CaO.2FeO.SiO_2$ mixed with two of the following substances: $CaO.SiO_2$, $CaO.2FeO$, $2FeO.SiO_2$, CaO, FeO, or SiO_2. These results are obtained from the diagram by the application to it of cross-section lines and study of these by the modern methods of studying fused mixtures. A similar study of lime alumina silicates is made, plotting Ackerman's, Gredt's and Seger's results, from a discussion of which the conclusion is drawn that all such slags contain $CaO.Al_2O_3.2SiO_2$ mixed with two of the following substances, $CaO.SiO_2$, $Al_2O_3.SiO_2$, $CaO.Al_2O_3$, CaO, Al_2O_3, SiO_2. Cerdierite and gehlenite do not occur in such liquid slags, but may form on solidification. Numerous other points explained are very interesting.

J. W. RICHARDS.

The Metallurgy of Titanium. BY A. J. ROSSI. *Trans. Am. Inst. Min. Eng.*, 32.—Several pages are used in proving that blast-furnace slags with 25 to 35 per cent. of titanium oxide have been regularly made, and are quite as fusible and fluid as ordinary lime-alumina silicates. The titanic acid is treated in the calculations as so much silica, and dolomite is used as a flux, in order that magnesia be present. Titanic acid is not reduced by carbon at the temperature attained in the blast-furnace, and the pig iron obtained from ores with as much as 40 per cent. TiO_2 analyzed less than 0.1 per cent. of titanium. This amount, however, makes the iron stronger and tougher, and increases the

depth of chill materially, so that it is eminently a chilling iron. In the open-hearth, the titanium is all removed from the pig iron used. The only way to introduce titanium into pig iron or steel is to make a ferro-titanium in the electric furnace, and introduce this into the melted metal. The furnace consists of a cavity in a built-up graphite block, into which dips a carbon electrode. Using ores containing 15 to 35 per cent. of titanium, mixed with carbon, as charge, an alloy with 12 to 35 per cent. titanium is produced. Using pure rutile, alloys up to 80 per cent. titanium have been produced. Using 200 H. P. current, 75 to 125 pounds of alloy is made per hour. Such alloys contain 7.5 to 9 per cent. carbon. Alloys free from carbon can be obtained by maintaining a bath of aluminum in an electric furnace, and melting thereupon, by the current, a bath of calcium titanate; excess of aluminum is used up by adding some iron oxide, and thus a rich, carbon-free alloy is obtained. Three per cent. of the carbon titanium alloy, added to cast-iron, increases the tensile and transverse strength 20 to 30 per cent., and makes a fine chilling iron. Pure titanium introduced into steel, from 0.1 to 1 per cent., increases considerably the ductility. The author suggests that in steel it not only deoxidizes, but may also remove nitrogen. He is now studying also alloys of titanium with copper and other metals.

J. W. Richards.

Progress in the Aluminum Industry in 1902. By J. W. Richards. *Al. World*, December, 1902. A résumé of progress in mining bauxite, purifying it, reduction to metal, and applications of the metal. The scientific study of the alloys of aluminum has received much attention in this year. The culinary utensil business has expanded considerably, aluminum printing has been very successful, and the Goldschmidt reduction and welding process has consumed much metal. J. W. Richards.

The Manganese Industry of Panama, Rep. of Colombia. By E. G. Williams. *Trans. Am. Inst. Min. Eng.*, 32 (1902).—Manganese ore occurs in small bodies over nearly 300 square miles, but only six mines have actually shipped ore. The first shipments were made in 1871. A railway 9 miles long was constructed to the mines in 1894. The ores occur on the lowlands near the sea as well as on the summits of the hills in the interior. The rocks immediately associated with the ores are of sedimentary origin. The principal ore is psilomelane, while pyrolusite and braunite also occur. Pockets of soft ore are sometimes found, but not often. Some of the harder ore appears to be a new mineral, $MnO.2MnO_2$. The ore is hand-picked, to keep the silica below the allowable limit of 8 per cent.; the phosphorus averages below 0.05; the best ore runs as high as 57.50 per cent. manganese; the average, 53.75 per cent. Detailed descriptions of several deposits are given. J. W. Richards.

A Wood-Burning Muffle Furnace. BY L. JANIN, JR. *Eng. Min. J.*, December 20, 1902.—A design for a double-muffle furnace, for use where coke and coal are dear and wood cheap. The wood was cut into 16-inch pieces, costing $4.50 per cord, and one-seventh of a cord was used per day. The furnace could be gotten up to heat, starting cold, in ninety minutes.

J. W. RICHARDS.

The Litharge Process of Assaying Copper-Bearing Ores. BY W. G. PERKINS. *Trans. Am. Inst. Min. Eng.*, 31, 913.—The scorification process is often rendered long and tedious by the necessity of repeatedly rescorifying because of copper in the button, thereby incurring risk of losing silver and gold. The author proposes to use a crucible assay, using litharge. Using half an assay ton of ore, 4 per cent. of sulphur, antimony or arsenic will reduce 16, 3 or 6 grams, respectively, of lead from PbO, while 1 gram of flour will reduce 10 grams of lead, and 1 gram of KNO_3 will oxidize 4 grams to PbO. The charge should be calculated so as to get a button of 16 grams. Salt is used as a cover, as there is less volatilization of gold with it than using borax. Arsenic and antimony interfere if they are over 4 per cent.

J. W. RICHARDS.

Detection and Estimation of Small Amounts of Gold and Silver. BY L. WAGONER. *Trans. Am. Inst. Min. Eng.*, 31, 798.—The object was to examine rocks remote from veins or mineral areas, in order to test the probability of the lateral-secretion theory. *Pure test lead* was prepared by electrolyzing pure lead acetate with a carbon rod anode, which deposits first a small amount of lead much higher in silver than the salt. The solution is filtered, crystallized, the crystals ignited in an iron spoon, and a mixture of lead and lead oxide obtained. This is reduced on coal without flux, to metal. By this means lead was obtained containing only 0.0000047 per cent. of silver. If any of the ordinary reagents are used as fluxes, more silver is found. Merck's C. P. soda contained over 0.0003 per cent. silver, and some KCN 0.00026 per cent. silver and 0.00000147 per cent. gold; when such reagents were used, their gold and silver content had to be allowed for. Boracic acid was the only reagent tested which showed no silver. *Assaying the rocks* was done by crushing to 60-mesh, taking 40 to 50 grams, and 60 cc. of water, containing 100 milligrams of KCN. This was put into a stoppered bottle, shaken at intervals for a day or two, filtered, evaporated with 400 milligrams of calcined lead acetate, and fused on coal B. B. Correction is afterwards made for the silver in the lead salt and silver and gold in the cyanide. *Fine cupellation* was performed on a cupel made of floated bone-ash, the upper surface having been burnished with the smooth end of the agate pestle. The *weight of the beads* was obtained by Goldschmidt's method of

measurement under the microscope, with a scale in the eye-piece. With a power of 60, each division represented 0.02001 millimeter, and by estimating tenths of a division, the diameters were measured to 0.002 millimeter, from which the weights were obtained. *Parting* was performed by placing the button in a drop of water on a fragment of porcelain, adding nitric acid, warming, and absorbing the silver nitrate by filter-paper, repeating the operation until only gold was left. Then a fragment of lead was placed on the gold, melted, transferred to a cupel and cupelled. *Sea-water* was tested by evaporating 1 cc. with 200 milligrams of lead and fusing on coal, and showed per ton of sea-water 1900 milligrams of silver and 16 milligrams of gold. Sea-weed showed, in some cases, much silver, reduced by the organic matter; bay-mud contains gold and silver thus precipitated. The following are some of the results obtained:

	Silver (per cent.).	Gold (per cent.).
Granite, American River, Cal	0.0000940	0.0000115
Syenite, Candelaria, Nev	0.0015430	0.0000720
Sandstone, Colusa Co., Cal. (Hayward Bldg.)	0.0000540	0.0000039
Marble, Carrara, Italy	0.0000201	0.000000863
Basalt paving block, Petaluma, Cal	0.0000547	0.0000026
Diabase, Mariposa Co., Cal	0.0007440	0.0000076

The results of this extraordinarily accurate investigation show the average ratio of silver to gold in these rocks to be 30 to 1, and confirm the belief that they were both deposited with the rock. Assuming underground circulating waters, the source of the gold and silver in veins can be found in the country rocks, thus rendering the lateral secretion theory plausible.

J. W. RICHARDS.

A Study of Amalgamation Methods, Especially the Patio Process, with the Object of Avoiding the Loss of Mercury. BY M. BUSTAMENTO, JR. *Trans. Am. Inst. Min. Eng.*, 32 (1902).—The ore treated by the author contained about 1 ounce of gold per ton, but amalgamation scarcely extracted one-tenth its assay value, and did not pay. A combined amalgamation and cyanide system saved 32 per cent., but still did not pay. By roasting the ore before treatment, the combined system extracted 63 per cent., with a loss of 11 per cent. of the mercury used, and the milling began to pay. The mercury was principally lost as sulphide. Precipitation of the cyanide solutions by zinc was subsequently replaced by electrical precipitation, increasing the extraction of the gold value of the ore 6 per cent. The author was then led to try amalgamation with the aid of the electrical current. The amalgamating plates in the mortars were connected with a dynamo giving 150 amperes, at 14 volts; the apron plates outside were also similarly connected, in series. Similar dispositions were made in the pans and washers, the plates being in series so that no pair had a higher electromotive force on them than 1.5 volts, while 10 amperes were used per square meter of

plate furnace. Roasting was dispensed with, and finally the perfected process extracted 95 per cent. of the gold, with a loss of but 0.03 per cent. of mercury, and at a cost of 42 cents per ton for crushing and 19 cents for amalgamation and electricity.

The Patio Process consumes ordinarily 1.5 ounces of mercury per ounce of silver obtained. This is higher than necessary, for by increasing the amount of salt and treating the torta slightly cold, the loss may be kept below half an ounce of mercury. By using amalgamated copper plates in the drains through which the torta is washed, connected in tension so as to obtain about 40 amperes per square meter at 1 to 2 volts tension, the collecting of the amalgam is greatly facilitated, and the author has obtained as much as 97 per cent. extraction of the silver with a loss of mercury only one-quarter the weight of silver obtained, or about 5 per cent. of the total mercury employed. The author develops a theory of the Patio process which cannot be well abstracted, but which is, in brief, that (1) ferric chloride forms in the torta, (2) its reduction to ferrous chloride chloridizes the silver, (3) precipitation of the silver by hydrated oxides in the mixture. This part of the paper will bear careful reading.

J. W. RICHARDS.

Note on Hydraulic Mining of Low-Grade Gravel. BY W. H. RADFORD. *Trans. Am. Inst. Min. Eng.*, 31, 617.—Figures as to very economical mining of low-grade gravel, running only 2.52 cents per cubic yard, which was washed at a cost of 2.20 cents per cubic yard, of which 10 per cent. was for the care of water supply, 10 per cent. for the actual washing, 5 per cent. for blasting, 4 per cent. for sluice building and repairing, 12 per cent. for supplies, 12 per cent. for general expenses, 16 per cent. for salaries, taxes, etc., and 30 per cent. for cleaning up, blacksmithing, clearing ground, etc. J. W. RICHARDS.

Experiments with Bromo-Cyanogen on Southern Gold Ores. BY S. H. BROCKUNIER. *Trans. Am. Inst. Min. Eng.*, 31, 793.—The ore was quartzite and schist, very hard, containing much silica and manganese, some alumina, and from 2 to 10 per cent. of pyrites. Average value, $8 per ton. Only 20 per cent. could be saved by amalgamation. The mine ore was concentrated 20 to 1, at a cost of $1 per ton of concentrates, which were then chlorinated by the Theiss process, but it did not pay. Plain cyanide solution on unroasted ore extracted 40 to 60 per cent. of the gold, but with large consumption of cyanide; with roasted ore the extraction was 80 per cent., but the loss of cyanide was still too high. Bromo-cyanogen was made by the following reaction:

$$5NaBr + 16HCl + K_2Mn_2O_8 + 5KCy + H_2O = 5BrCy + 2MnCl_2 + 5NaCl + 7KCl + 9H_2O,$$

and the process used was to wash for one hour with 0.2 per cent.

sulphuric acid, then with water, then for one hour with 0.2 per cent. potassium hydroxide solution, then for forty-eight hours with 25 per cent. of its weight of 0.3 per cent. cyanogen bromide solution, containing also 0.3 per cent. potassium cyanide. The extraction was 70 per cent., which the author thinks can be eventually raised to 85 per cent. while the loss of potassium cyanide was insignificant. The author is convinced that the method is very suitable for many southern gold ores.

J. W. RICHARDS.

The Mechanical Feeding of Silver-Lead Blast-Furnaces. BY A. S. DWIGHT. *Trans. Am. Inst. Min. Eng.*, 32 (1902).—At Pueblo and East Helena, mechanical feeding has been in continuous and successful operation for a long time, and has clearly passed its experimental stage. The reactions in a lead furnace are entirely different from those in the iron furnace, since some metals have to be reduced and some oxidized, and the extent to which the lead and copper are reduced to metal, and the iron reduced only to the state of FeO, is the key to successful smelting. The reducing gases tend naturally to travel close to the furnace walls; no furnace fed with coarse ore on the sides and fine ore in the middle can possibly do good work; the opposite manner of feeding must be used, so as to cause the gases to ascend as uniformly as possible over the whole sectional area of the furnace. This is attained in a mechanical feeder by having underneath the bell a cone-shaped "spreader," and around it a circular curtain, reaching a little lower than the bottom of the spreader. Large lumps of ore bound from the spreader, strike the curtain and rebound under the spreader into the middle of the furnace, while the finer material slides down the spreader, misses the lower edge of the curtain and is discharged towards the walls. By varying the relative sizes and heights of spreader and curtain, any desired effect can be produced, and the uncertain human element in charging eliminated as much as possible. J. W. RICHARDS.

The Cyanide Assay for Copper. BY H. H. MILLER. *Trans. Am. Inst. Min. Eng.*, 31, 653.—Ten grams of ore are put into a No. 4 porcelain casserole, and digested with acid until dissolved; excess of dilute ammonia is added, the assay kept warm five minutes and filtered, the bulk of the filtrate and washings being not over 180 cc. The solution being cool, and made up to 180 cc., is titrated by standardized KCN, the color fading until the violet tint is very faint; then filter and bring it to a delicate, hardly-perceptible rose-pink, by adding more KCN. In the discussion, Mr. E. Keller called attention to the fact that the results by this method were too high if zinc had not been previously separated from the solution. J. W. RICHARDS.

On the Presence of Iron in Copper or Its Alloys. BY E. S. SPERRY. *Al. World*, December, 1902.—Iron ordinarily separates out in small round pellets, sometimes as large as a pea; they are really nodules of steel, and extremely hard. They cause great difficulty in machining the metal, especially in automatic machines. In making sheet brass or copper, such nodules will indent chilled rolls. Such spots also show iron rust when the metal is exposed to water or moist air. In sterro-metal, delta-metal and manganese bronze, iron is contained absolutely chemically combined; it is introduced by first alloying it with zinc, or manganese, and then introducing this alloy into the metal. Any carbon present in these alloys throws the iron out of combination as steel.

J. W. RICHARDS.

The Lead and Zinc Deposits of North Arkansas. BY J. C. BRANNER. *Trans. Am. Inst. Min. Eng.*, 31, 572.—A 30-page discussion, by the former director of the state geological survey. His general conclusions are that (1) the ores are remarkably pure; (2) the zinc ores were originally deposited as disseminated ores in sedimentary beds, mostly of organic origin, in which some of them are still found; (3) the position of the ores in the beds has been changed, more or less, since they were originally deposited; (4) these changes have been going on since the original deposition, and are still in progress; (5) vertical and other fissures have been filled by ores brought into them by circulating waters from above, from below, and from the sides; (6) the position of the ores in the secondary deposits has been determined largely by the same structural features which have guided the underground waters; (7) the accumulations of ore have taken place sometimes along synclinal troughs, sometimes along fault-lines, and sometimes in the breccias formed along other ancient underground water-courses; (8) the carbonates and silicates have been produced, mostly in place, by the alteration of sulphide ores.

J. W. RICHARDS.

The Klein Jig and the Klein Classifier. BY F. H. REGEL. *Trans. Am. Inst. Min. Eng.*, 31, 619.—The writer believes that the recent prosperity of the mining industry is due largely to the improvements in concentrating machinery; many once worthless properties are now profitably operated because of these improvements. The Klein jig and ore classifier is in use in the lead region of southeast Missouri and in Montana. At a Missouri plant, 27 jigs, of four compartments each, are treating 450 to 500 tons of lead ore every twenty-four hours, extracting 90 per cent. of the metallic value from a 2.5 per cent. ore which had been thrown aside as unworkable. In this jig, all the plungers are operated by one eccentric, and compressed air at 25 to 35 pounds pressure is used as an auxiliary. This use of air in combination with water is a new departure, which works very well. The ma-

chines are described in U. S. Patents 674,169 and 674,269, of May 14, 1901. J. W. RICHARDS.

ORGANIC CHEMISTRY.

On the Action of Aniline upon Tetrabrom-*o*-Benzoquinone. BY C. LORING JACKSON AND H. C. PORTER. *Ber. d. chem. Ges.*, 35, 3851–3854.—By adding an alcoholic solution of tetrabrom-*o*-benzoquinone to an alcoholic solution of aniline, aniline and alcohol addition-products of dianilinodibrom-*o*-benzoquinone result. The filtrate from these precipitates when boiled gives dianilinobrom-*p*-benzoquinoneanil, and the latter by long boiling with aniline changes to dianilino-*p*-benzoquinoneanil. *Dianilinodibrom-o-benzoquinone*, $C_6Br_2O_2(NHC_6H_5)_2$, was separated from its aniline addition-product by heating at 50° with a mixture of benzene and ligroin, and recrystallizing from the same mixed solvents until the melting-point remained constant at 160°. Reddish-purple needles. *Aniline dianilinodibrom-o-benzoquinone*, $C_6Br_2O_2(NHC_6H_5)_2$, $C_6H_5NH_2$, is the first product of the action of aniline upon the tetrabrom quinone, and may also be prepared by boiling the dianilinodibrom quinone with benzene and some aniline. Fine light-brown needles, m. p. 123°, decomposed by heating dry or in solution to 50°–60°, or by the action of acids. Loses its aniline when warmed with benzene. *Dianilinodibrom-o-benzoquinonemonoethylhemiacetate*, $C_6Br_2O_2(NHC_6H_5)_2, C_2H_5OH$, is produced by the action of alcohol upon the dianilinodibrom quinone at ordinary temperature. Rectangular yellow plates, from benzene; heated dry or in solution to 60°, it slowly loses its alcohol; rapidly heated, it liquefies at about 143° with simultaneous decomposition. With methyl alcohol, a similar addition-product is obtained, whose decomposition point lies at about 144°–145°. *Dianilinobrom-p-benzoquinoneanil* is obtained from the preceding substances by boiling them with aniline bromide and alcohol; if the reaction is continued too long, dianilino-*p*-benzoquinoneanil is formed. The bromine derivative is purified by crystallization from a mixture of benzene and methyl alcohol and forms rhombic glistening black plates, m. p. 173°. It is probably a para derivative, since by the action of a dry ether solution of SO_2, even at the ordinary temperature, it is changed to the paraquinoneanil, m. p. 202°–203°. M. T. BOGERT.

On Tetrachlordinitrobenzene. BY C. LORING JACKSON AND H. A. CARLTON (Preliminary communication). *Ber. d. chem. Ges.*, 35, 3855–3857.—1,2,3,5-Tetrachlorbenzene was prepared from 2,4,6-trichloraniline by the Sandmeyer reaction, and yielded the mononitro derivative when boiled for half an hour with fuming nitric acid. The dinitro derivative was produced from the latter by boiling it with a mixture of concentrated sulphuric

and fuming nitric acids. *1,2,3,5-Tetrachlor-4,6-dinitrobenzene*, as thus prepared, and recrystallized from 90 per cent. acetic acid, forms large white rhombic crystals, m. p. 161°-162°, little soluble in alcohol or cold glacial acetic acid, easily soluble in other organic solvents. Dissolved in benzene and treated with an absolute alcohol solution of sodium ethylate, cooling with ice, it yields what are probably the *chlordinitrophloroglucintriethylether* and the *chlordinitrophloroglucindiethylether*. The former crystallizes from alcohol in long white needles, m. p. 76°. The latter crystallizes from ligroin or from dilute alcohol in thin yellow needles, m. p. 102°-103, and forms salts, of which the barium and lead compounds precipitate in aqueous solutions. The *barium salt* crystallizes from water in small yellow needles, being nearly insoluble in cold water. The combined amount of these two phloroglucin ethers present in the crude reaction-product is only about 10 per cent. of the whole, the chief constituent being apparently an *oil*, volatile with steam, which decomposes when distilled at ordinary pressure, and which is formed in still larger amount when the reaction is conducted at the boiling-point of the alcohol. The nature of this oil has not as yet been determined.

M. T. BOGERT.

On Triphenylmethyl. Condensation to Hexaphenylethane. (Sixth Paper.) BY M. GOMBERG. *Ber. d. chem. Ges.*, 35, 3914-3920.—The author observed this hydrocarbon first in the preparation of triphenylchlormethane, and later obtained small amounts of the same substance on treating triphenylmethyl with acetic and nitrous acids. The pursuit of this latter reaction led to the study of the action of metals upon triphenylchlormethane in glacial acetic solution, as a result of which the methods for the preparation of the hexaphenylethane were worked out. Subsequently, catalytic agents were discovered by which triphenylmethyl was directly condensed to hexaphenylethane. I. *Formation from carbon tetrachloride and benzene.* It was repeatedly observed in the preparation of triphenylchlormethane by the author's method that small amounts of a hydrocarbon were formed, melting at 225° and insoluble in ether, and which is now identified as hexaphenylethane. II. *Action of metals upon triphenylchlormethane in glacial acetic acid.* Since triphenylmethyl is but slightly soluble in glacial acetic acid, the effect of acids upon nascent triphenylmethyl was investigated by acting upon glacial acetic acid solutions of triphenylchlormethane with molecular silver, granulated tin or zinc strips. In the cold, the effect of these various metals was simply to produce triphenylmethyl, while at higher temperatures hexaphenylethane was produced. The latter is but little soluble in hot glacial acetic acid, scarcely soluble in alcohol or ether, moderately soluble in cold benzene and rather more so in chloroform ; it is saturated and very stable

towards oxidizing agents. Its formation from triphenylchlormethane is believed to be due to the condensing action of the hot glacial acetic acid upon the nascent triphenylmethyl, although the same result could not be accomplished by the direct action of acetic acid upon triphenylmethyl. III. *Condensation of triphenylmethyl to hexaphenylethane.* The chlorethers, especially the monochlor derivatives of ethyl and methylethyl ethers, possess the power of condensing triphenylmethyl to hexaphenylethane. The polymerization by these reagents is accomplished very rapidly and the yield of hexaphenylethane is nearly quantitative. Purified hexaphenylethane, as thus obtained, shows a melting-point of 226°–227° (uncorr.). The important bearing of this condensation upon the constitution of triphenylmethyl is evident.

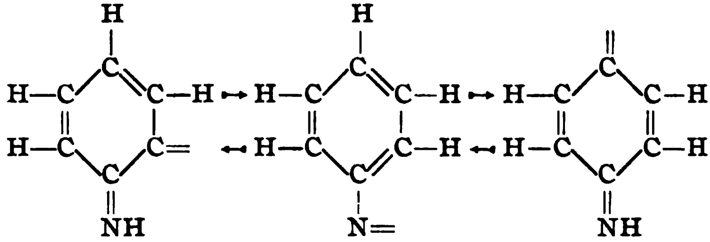
M. T. BOGERT.

On the "Beckmann Rearrangement." II. BY JULIUS STIEGLITZ. *Am. Chem. J.*, **29**, 49–68.—This paper contains a critical review of the various interpretations which have been suggested for the Beckmann rearrangement, together with additional deductions in support of the explanation advanced by the author in 1896. This explanation is briefly as follows: The parallel classes of derivatives, RCONHBr(I), RCONH(OCOR)(II), $R_2C(NOH)$ (III) and $RCON(N_2)$(IV), may all readily yield identical or closely similar intermediate derivatives, with univalent nitrogen, *e. g.*, (RCO)N : . Such a derivative would result from (I) by loss of HBr, from (II) by loss of RCOOH, from (IV) by loss of N_2, while the loss of water from the chloride of (III), $R_2CClNHOH$, would give R_2CClN : . The reagents used to effect the rearrangement agree with this conception—alkalies for (I) and (II), heat for (IV), and acid dehydrating agents for (III). It is the intermediate product, in this case RCON : , which actually suffers the rearrangement, owing to the potency of the free valences of univalent nitrogen,

$$\begin{array}{l} \mathrm{OC—N} \\ \;| \quad \wedge, \\ \;\mathrm{R} \end{array} \qquad \begin{array}{l} \mathrm{OC—NR} \\ \;| \qquad | \;, \end{array} \qquad \begin{array}{l} \mathrm{OC:NR} \\ \qquad\quad , \end{array}$$

an isocyanate being the first tangible product in this case. Where the structure of the substances is such as to preclude the formation of these hypothetical intermediate bodies, no rearrangement occurs. Many observed facts are cited in support of this hypothesis. For instance, β-phenylhydroxylamine, when heated, yields azobenzene and water, a reaction which may be expressed as follows: $C_6H_5NHOH = C_6H_5N: + H_2O$, and $2C_6H_5N: = C_6H_5N:NC_6H_5$. At the same time, a strong carbylamine odor appears, and the author suggests that this odor may not be due to a carbylamine at all, but to small quantities of the analogous phenylimide, C_6H_5N : , or its isomeric imidophenylenes, which have escaped instantaneous condensation. He believes it to be

likely that the phenylimide as soon as formed suffers partial isomerization to imidophenylenes :



and explains the change of phenylhydroxylamine to *p*-oxydiphenylamine and other reactions by applying this conception: $:C_6H_4:NH + H_2O = :C_6H_4:O + NH_3$, and $:C_6H_4:O + H_2NC_6H_5 = C_6H_5NH(H)C_6H_4:O = C_6H_5NHC_6H_4OH$. Also, $C_6H_5NHNHC_6H_5 + HX = C_6H_5N: + C_6H_5NH_2X$, and $C_6H_5N: = :C_6H_4:NH$(*p*- and *o*-), then *p*-$HN:C_6H_4: + C_6H_5NH_2 = HN:C_6H_4(H)C_6H_4NH_2 =$ *p*-$H_2NC_6H_4C_6H_4NH_2$ ("benzidine rearrangement"). In similar manner, *o*-$HN:C_6H_4: + C_6H_5NH_2 =$ *o*-$H_2NC_6H_4C_6H_4NH_2$ (*p*) ("diphenyline rearrangement"), and $HN:C_6H_4: + H_2NC_6H_5 = HN:C_6H_4(H)NHC_6H_5 = H_2NC_6H_4NHC_6H_5$ ("semidine rearrangement"). The structure of the salts of the acid chloramides was determined as RC(OMe)(NHal). Benzchloramide can be titrated quantitatively with standard alkali, using phenolphthalein as indicator. Further data will appear in a subsequent article. M. T. BOGERT.

On the Action of Phenylhydrazine on Benzoylpseudothioureas: 1,5-Diphenyl-3-Aminopyrro-α,β'-Diazole Derivatives. BY HENRY L. WHEELER AND ALLING P. BEARDSLEY. *Am. Chem. J.*, **29**, 73–82.—The authors have shown already that acylpseudothioureas readily react with phenylhydrazine to form aminotriazoles. In the case of the benzoylpseudothioureas, the structure of the products is now proved to be that of 1,5-diphenyl-3-aminotriazoles, and the reaction by which they are formed is therefore as follows:

$$\begin{array}{l} C_6H_5CON:C(SCH_3)NRR' \\ \qquad + \\ C_6H_5NH{-}NH_2 \end{array} = \begin{array}{l} C_6H_5C{=}N{-}C{-}NRR' \\ \quad | \qquad\quad \| \\ C_6H_5N{-}{-}{-}{-}N \end{array} + CH_3SH + H_2O.$$

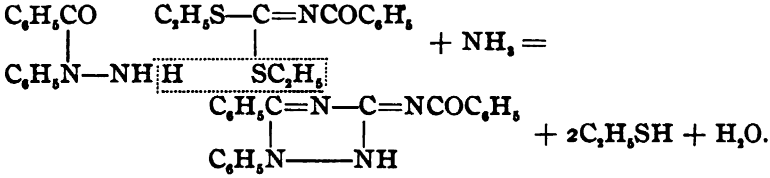
So far as this reaction has been examined, the NH_2 group of the phenylhydrazine invariably attacks the mercaptan group in preference to the CO. EXPERIMENTAL.—*Benzoylthiolbenzylpseudothiourea*, $C_6H_5CON:C(SCH_2C_6H_5)NH_2$, prepared by the action of dilute potassium hydroxide and benzyl chloride upon benzoylthiourea, crystallizes from alcohol in glistening white plates,

m. p. 161°, insoluble in ether or benzene, soluble in hydrochloric acid. *1,5-Diphenyl-3-aminotriazole.*—Equal molecules of phenylhydrazine and the above pseudothiourea, or benzoylthiolmethylpseudothiourea, were heated on the water-bath for three or four hours in benzene solution, the solvent evaporated, residue washed with ether and crystallized from alcohol. Colorless prisms, or striated plates, m. p. 154.5°, very difficultly soluble in water or cold benzene, readily in hot benzene or alcohol, not attacked by strong boiling sulphuric acid or potassium hydroxide. Dissolved in hydrochloric acid and treated with sodium nitrite at 0°, crystals are obtained apparently identical with 1,5-diphenyl-3-chlortriazole of Cleve (*Ber. d. chem. Ges.*, **29**, 2672 (1896)). The *picrate* of the aminotriazole forms yellow lozenge-shaped plates, m. p. 183°; the *chloride*, small, colorless plates, melting at 205° without effervescence. *1,5-Diphenyl-3-benzoylaminotriazole*, prepared by the action of benzoyl chloride upon the foregoing aminotriazole in warm benzene solution, can also be obtained from the benzoyl chloride addition product by shaking with alkali and dissolving out the product with benzene, or by heating the substance to its melting-point, whereby HCl is driven off. It crystallizes from dilute alcohol or from benzene and ligroin, m. p. 159°–160°, and is readily soluble in benzene or alcohol. Its alcoholic solutions are precipitated by water. Hydrochloric acid changes it to a chloride, identical with the benzoyl chloride addition product. The *sulphate* melts at 195°. *Chloride* or *benzoyl chloride addition product.* When the aminotriazole is warmed on the water-bath with an excess of benzoyl chloride, in absence of a solvent, the triazole dissolves and then suddenly precipitates as a solid cake of this addition product, which crystallizes from alcohol in bunches of small colorless plates, melting at 205° with effervescence, and insoluble in benzene. *1,5-Diphenyl-3-acetylaminotriazole chloride* is produced by the action of acetyl chloride upon the aminotriazole. White powder, m. p. 156°–157°. The constitution of these triazole derivatives was settled by the two following syntheses: I. *a,c-Dibenzoyl-a-phenylaminoguanidine*, $C_6H_5N(COC_6H_5)NH.C(NH)NHCOC_6H_5$. By shaking phenylaminoguanidine, in ether, with benzoyl chloride and alkali, this benzoyl derivative may be produced. It melts, with effervescence, at 156°. Boiled with absolute alcohol, it is dehydrated, yielding 1,5-diphenyl-3-benzoylaminotriazole, and if the benzoyl group is split off by boiling with strong hydrochloric acid, the resulting aminotriazole is identical with the condensation product, already described, of phenylhydrazine and benzoylpseudothioureas:

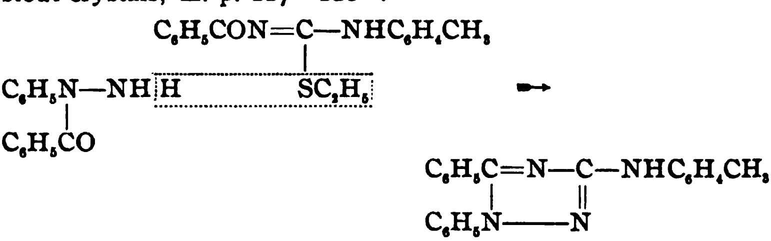
$$
\begin{array}{lcl}
H_2N\text{—}C\text{=}NH & & C_6H_5C\boxed{O\quad H_2}N\text{—}C\text{=}NCOC_6H_5 \\
\qquad\;\; | & \longrightarrow & \quad\;\; | \qquad\qquad\qquad\;\; | \\
C_6H_5NH\text{—}NH & & C_6H_5N\text{————————}NH
\end{array}
$$

II. *a-Phenyl-a,c-dibenzoylthiolethylpseudothiosemicarbazide*, C_6H_5N

$(COC_6H_5)NH.C(SC_2H_5):NCOC_6H_5$, produced by the action of unsymmetrical benzoylphenylhydrazine upon benzoyliminodiethyldithiocarbonate, forms square plates (from benzene), m. p. 170°–171°, difficultly soluble in alcohol were pure. Boiled with alcoholic ammonia, this carbazide passes into *a*-phenyl-*a,c*-dibenzoylaminoguanidine, which then loses water and condenses to 1,5-diphenyl-3-benzoylaminotriazole:



1,5-Diphenyl-3-phenylaminotriazole, prepared from equal molecules of benzoylphenylthiolethylpseudothiourea, $C_6H_5CONHC(SC_2H_5):NC_6H_5$, and phenylhydrazine, crystallizes from alcohol in fine white needles, m. p. 202°. It does not form a chloride, and is unattacked by boiling with strong alkali. *1,5-Diphenyl-3-benzoylphenylaminotriazole* is obtained from the latter by the action of benzoyl chloride. It crystallizes from alcohol in compact ill-formed prisms, m. p. 148°–149°, insoluble in ligroin, very soluble in benzene. *1,5-Diphenyl-3-paratolylaminotriazole.* By warming together, in alcoholic solution, equal molecules of *a*-benzoyl-*a*-phenylhydrazine and benzoylparatolylthiolethylpseudothiourea, *a,c-dibenzoyl-c′-paratoyl a-phenylaminoguanidine* is produced. It forms long colorless needles, melting at 279° with effervescence, and is difficultly soluble in alcohol. When this substance is boiled with dilute alcoholic potash, it is converted, by the splitting off of one benzoyl group and the loss of water, into the paratolylaminotriazole, which forms beautiful, colorless, minute, stout crystals, m. p. 227°–228°:



This triazole is identical with the substance previously obtained by Wheeler and Johnson (*Am. Chem. J.*, **26**, 414 (1901)) from benzoylparatolylthiolethylpseudothiourea and phenylhydrazine. *Benzoylmethylphenylthiolmethylpseudothiourea*, $C_6H_5CON:C(SCH_3)N(CH_3)C_6H_5$, is produced by heating together, in benzene solution, equal molecules of benzoyliminodithiodimethylcarbonate and methylaniline. It crystallizes from alcohol in colorless prisms,

m. p. 113°. *1,5-Diphenyl-3-methylphenylaminotriazole*, from equal molecules of benzoylmethylphenylthiolmethylpseudothiourea and phenylhydrazine left for several days in a cold mixture of benzene and alcohol, forms lozenge-shaped plates, very insoluble in alcohol, and melting with effervescence at 202°–203°, after showing signs of melting about 5° lower. M. T. BOGERT.

The Decomposition of Diazonium Salts with Phenols. BY JAS. F. NORRIS, B. G. MACINTIRE AND W. M. CORSE. *Tech. Quart.*, 15, 326–334 ; *Am. Chem. J.*, 29, 120–129.—In studying the preparation of phenol from aniline, the authors were led to the view that when a diazonium salt decomposes in presence of water and a phenol, it reacts to a much larger extent with the phenol than with the water, and it was found that when this decomposition took place at 75°–100°, good yields of diphenyl derivatives were obtained. With phenol, the main product is *p*-oxydiphenyl, with smaller amounts of phenyl ether and what appears to be *o*-oxydiphenyl. With pyrocatechin, it is a dioxydiphenyl, with smaller amounts of *o*-oxyphenylether and what is evidently an isomer of the dioxydiphenyl. Resorcin, rather strangely, gave no diphenyl derivatives, and only the azo-compound was isolated. Preliminary experiments with hydroquinone indicate that a *p*-oxyphenylether is the main product of the reaction, while a diphenyl derivative is produced to a less extent. The introduction of a phenyl group into the ring of pyrocatechin or hydroquinone modifies their properties and considerably increases their reactivity. The phenyl derivative of hydroquinone is oxidized by atmospheric oxygen to a dark blue compound, which can be reduced by SO_2 to a colorless substance. The ethers produced in these reactions are stable and do not reduce ammoniacal silver nitrate solution. The number of OH groups present in the compounds was determined by preparing their acetyl derivatives. In some cases, methyl ethers also were made. A description of the compounds prepared from hydroquinone will appear in a later paper. EXPERIMENTAL.—*Decomposition of benzene diazonium sulphate with phenol.*—Phenol, mixed with small quantities of water and heated on a boiling water-bath, was treated gradually with a cold aqueous solution of the diazonium sulphate, and the heavy black oil obtained distilled with superheated steam (140°–160°), unchanged phenol coming over first, then a mixture of *o*- and *p*-oxydiphenyls, and finally almost pure *p*-oxydiphenyl. The separation of the *o*- and *p*-oxydiphenyls was secured by crystallization from petroleum ether (b. p. 50°–80°), in which the para compound is the less soluble. 40 grams of aniline yielded 20 grams of the *p*-oxydiphenyl and 1.5 grams of its isomer. This isomer crystallizes in colorless needles, m. p. 67.5°, and is probably the *o-oxydiphenyl*. *Decomposition of benzene diazonium chloride with pyrocatechin.*—The reac-

tion between these substances was conducted at 75°, and the crude product subjected to steam distillation. The solid which came over with the steam proved to be *o*-oxydiphenyl ether. The aqueous solution remaining in the flask, decanted from the non-volatile oil, contained dioxydiphenyl, more of which was extracted from the non-volatile oil by boiling with water. From the insoluble non-volatile oil there was separated a small amount of a *compound*, m. p. 147.5°–148.5°, evidently a pyrocatechin derivative, and probably an isomer of the dioxydiphenyl. From 40 grams of aniline, 4.6 grams of *o*-oxydiphenylether and 9 grams of dioxydiphenyl were obtained. *o-Oxydiphenylether* crystallizes from dilute alcohol in flat needles, and from petroleum ether in well-formed six-sided needles terminated by domes, m. p. 105°–106°. It has an aromatic odor, is very soluble in carbon bisulphide, benzene or glacial acetic acid, less soluble in toluene, and only slightly soluble in petroleum ether or hot water. It gives no color with ferric chloride, and shows none of the reactions characteristic of pyrocatechin. Its *acetyl derivative* is a thick oil, soluble in the usual organic solvents, and distils without decomposition at 358°–360° (uncorr.). Its *methyl ether* crystallizes from methyl alcohol in long, flat, six sided crystals, m. p. 77°, and is soluble in the ordinary solvents. *Dioxydiphenyl*, recrystallized from petroleum ether, melts at 136°–136.5°, and boils without decomposition above 360°. It is very soluble in alcohol, chloroform or ether, less so in carbon bisulphide, petroleum ether or hot water. It gives color reactions with ferric chloride, reduces silver nitrate solution, and gives precipitates with lead nitrate or bromine water. Its *diacetyl derivative* crystallizes from alcohol in long, six-sided crystals, m. p. 77°–77.5°. Attempts to determine the structure of this dioxydiphenyl by oxidation of its dimethyl ether (to veratric acid, etc.) were unsuccessful.

M. T. BOGERT.

The Action of Zinc on Triphenylchlormethane. BY JAMES F. NORRIS AND LLORA R. CULVER. *Am. Chem. J.*, **29**, 129–140.—The highly unsaturated compound obtained by Gomberg by the action of zinc upon triphenylchlormethane possesses such unusual interest that the authors have continued the experiments in this field begun by one of them (Norris) four years ago, the object of the present investigation being to discover whether any explanation of this remarkable reaction, other than that of trivalent carbon, can be found. An attempt was, therefore, made to determine quantitatively the substances which entered into the reaction and the products formed, and it was found that the statement of Gomberg that when zinc and triphenylchlormethane react, in benzene solution, quantitative results are obtained according to the following equation: $2(C_6H_5)_3CCl + Zn = 2(C_6H_5)_3C— + ZnCl_2$, was not correct. Part of the triphenylchlormethane

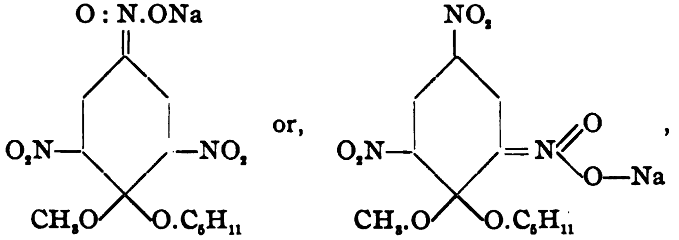
escapes the action of the metal. When a solution of triphenylchlormethane in ethyl acetate is treated with zinc, in absence of moisture and oxygen, a highly unsaturated substance is formed, which readily absorbs oxygen with formation of an insoluble peroxide, $(C_6H_5)_3C.O.O.C(C_6H_5)_3$. In the filtrate from this peroxide, triphenylmethane, triphenylcarbinol and an oil are at times present. Nef explained the formation of triphenylmethane from zinc and triphenylbrommethane by the assumption of an unstable intermediate compound, $(C_6H_5)_2C{-}C_6H_4$, which was partly reduced to triphenylmethane, and partly polymerized to a red tar, and the authors believe it highly probable that a similar explanation applies to the presence of triphenylmethane and an oil among the products of the action of zinc upon triphenylchlormethane. An attempt to prepare a compound of the formula, $(C_6H_5)_2C{:}C_6H_4$, by the action of pyridine upon triphenylchlormethane at ordinary temperatures, gave only a *pyridine addition product*, $(C_6H_5)_3CCl.C_5H_5N$, which separated in large pink crystals, m. p. 167°–167.5°. To explain the formation of the triphenylcarbinol, the amount of oxygen absorbed by the unsaturated compound (triphenylmethyl), the weight of zinc consumed, etc., were determined quantitatively in a special apparatus. The results of this quantitative examination show that the reaction between zinc and triphenylchlormethane is very complicated; much more zinc is used up than is called for in Gomberg's equation, much more oxygen is absorbed than is contained in the peroxide, and the percentage of the latter obtained is less than that found by Gomberg. The authors suggest that a zinc alkyl compound may be formed in the reaction, which yields the triphenylcarbinol by absorption of oxygen, and in support of this assumption call attention to the fact that zinc hydroxide was shown to be present in some of the experiments. The formation of the peroxide, however, cannot be referred to a hypothetical zinc alkyl, and the authors conclude that the facts observed by them do not prove or disprove the conception of a trivalent carbon.

The Action of Zinc on Benzoyl Chloride. By James F. Norris and D. R. Franklin. *Am. Chem. J.*, 29, 141–149.—In connection with their investigation of the action of zinc upon triphenylchlormethane in ethyl acetate solution (see preceding review), the authors have studied the action of zinc on benzoyl chloride under similar conditions. The reaction is completed much more slowly than in the case of triphenylchlormethane. From a series of experiments, in which the conditions were constantly varied, the following conclusions are drawn: (1) At room temperature, zinc removes chlorine from benzoyl chloride without the formation of hydrogen chloride. (2) The molecular quantities of the two substances which react are approximately

those represented by the equation : $2C_6H_5COCl + Zn = 2C_6H_5CO— + ZnCl_2$. (3) When the reaction is carried out in the presence of oxygen, only a small quantity of the gas is absorbed. (4) When the reaction product, after the removal of zinc chloride, is subjected to crystallization, benzoic acid and an amorphous solid are obtained. When distilled, the products obtained are benzoic acid, benzoic anhydride, and a small undistillable residue. (5) When the reaction is carried out either in the presence of, or in the absence of, oxygen, no dibenzoyl is formed. (6) In some of the experiments, more zinc was used than is required by the equation given above and zinc hydroxide was formed when a solution of the reaction product was treated with water. These observations indicate that to some extent an organo-metallic compound was formed. (7) The reaction between zinc and benzoyl chloride is such a complicated one that it cannot be interpreted by use of the facts so far discovered. In the course of the experiments it was found that when benzoyl chloride and zinc chloride are heated together with ethyl acetate under a return condenser, a very reactive compound is formed apparently made up of a combination of the two chlorides.

M. T. BOGERT.

On Certain Colored Substances Derived from Nitro Compounds. BY C. LORING JACKSON AND R. B. EARLE. *Am. Chem. J.*, 29, 89–120.—The authors have continued the study of the colored addition-compounds obtained from the nitro derivatives of benzene with sodium alcoholates, or with other alkaline bodies. The work of other investigators in this field is discussed, and the name "quinolnitro acids," suggested for these substances by Meisenheimer, is adopted. Experimental data are given in support of the quinoid formula previously proposed by Jackson and Gazzolo. Thus, the addition of sodium isoamylate to trinitroanisol gives a substance of the following structure :



which, when treated with dilute hydrochloric acid, breaks down into about equal molecules of trinitroanisol and isoamyl picrate. Substances were also prepared containing two molecules of the alkaline body to one of the nitro compound. EXPERIMENTAL.—*Preparation of trinitroanisol.*—Anisic acid was nitrated by a mixture of equal volumes of fuming nitric and fuming sulphuric

acids at 70°, the yield of trinitroanisol being 60 per cent. of the theory. *Addition-compound of trinitroanisol with sodium isoamylate (sodium salt of dinitromethoxyisoamyloxyquinolnitro acid)*, $C_6H_2(NO_2)_3OCH_3(NaOC_5H_{11})$.—Prepared by the action of sodium isoamylate upon an excess of trinitroanisol, in dry benzene solution. Bright crimson powder, stable *in vacuo*, but instantly decomposed by dilute acids with formation of trinitroanisol and isoamyl picrate. *Conversion of the addition-compound of trinitroanisol and sodium methylate into the isoamyl compound.*—$C_6H_2(NO_2)_3OCH_3.NaOCH_3$, mixed with isoamyl alcohol and warmed to 70°, yielded $C_6H_2(NO_2)_3OC_5H_{11}.NaOC_5H_{11}$. *Other experiments on the constitution of the addition-compounds (quinolnitro acids).*—$C_6H_2(NO_2)_3OCH_3.NaOCH_3$ reacts with aniline to give a red salt, which is evidently the sodium salt of picryl anilide, $C_6H_2(NO_2)_3NNaC_6H_5$, while, with an alcoholic solution of hydroxylamine, it gives the sodium salt of picryl hydroxylamine; with phenylhydrazine, the reaction is too violent to give good results, at 100° the mixture takes fire in a few minutes, and, even in the cold, tarry products result; with dimethylsulphate, methyl iodide, acetyl or benzoyl chlorides, no products could be isolated containing the organic radical instead of the sodium. *Addition-compound from trinitrobenzene and sodium methylate (sodium salt of nitrodimethoxydiquinolnitro acid)*, $C_6H_3(NO_2)_3(CH_3ONa)_2$.—Red, amorphous substance, decomposing in a few hours, even *in vacuo*. Heated suddenly to 100°, it explodes with great violence, but by raising the temperature gradually it may be heated to 150° without apparent change (except darkening) and without giving off any alcohol. Its decomposition appears to follow two lines: one consists essentially in the oxidation of one or more of the methoxy groups to formaldehyde, with compensating reduction of nitro groups to tetranitroazoxybenzene, while another reaction is indicated by the formation of nitrite and probably of some nitrophenol. *Addition-compound of trinitroanisol with two molecules of sodium methylate (sodium salt of nitrotrimethoxydiquinolnitro acid)*, $C_6H_2(NO_2)_3OCH_3(NaOCH_3)_2$.—Prepared by the action of a large excess of sodium methylate upon a dry benzene solution of trinitroanisol. Amorphous orange powder, much less stable than the similar compound with only one molecule of methylate. It decomposes in a manner resembling the foregoing trinitrobenzene compound, and is freely soluble in water. *Addition-compound of trinitroanisol and potassium cyanide (potassium salt of nitrocyandiquinolnitro acid)*, $C_6H_2(NO_2)_3OCH_3(KCN)_2$.—Dark, reddish brown amorphous substance, freely soluble in water or alcohol, and very unstable. *Addition-compound of trinitrobenzene and sodium phenylate (sodium salt of nitrodiphenoxydiquinolnitro acid)*, $C_6H_3(NO_2)_3(NaOC_6H_5)_2$.—Bright brick-red amorphous powder, decomposed immediately by water, and one of the least stable of the compounds analyzed. *Addition-compound of barium*

dinitrobenzenesulphonate and sodium methylate (*barium sodium salt of nitrosulphomethoxyquinolnitro acid*), $(C_6H_2(NO_2)_2NaOCH_3.SO_3)_2Ba$.—Amorphous, pale salmon powder when dry, but turns red when moistened with benzene, chloroform or ligroin. It is soluble in water, methyl or ethyl alcohol, but insoluble in the other common solvents. It appears to be one of the most stable compounds of this class. M. T. BOGERT.

On Azoxybenzylidene Bases. BY FRIEDRICH J. ALWAY. *Ber. d. chem. Ges.*, 35, 2434–2438.—*p-Azoxybenzylidenaniline*, $C_{14}H_{10}ON_2(:NC_6H_5)_2$, may be prepared by adding solid sodium hydroxide or potassium hydroxide to a boiling alcoholic solution of *p*-nitrobenzylaniline, the yield being about 70 per cent. of the theory. More convenient methods, and giving better yields, are those in which the base is prepared direct from *p*-nitrobenzyl chloride, aniline and sodium hydroxide, in alcoholic solution. Starting with *p*-nitrobenzylaniline, absolute alcohol may be used as the solvent, but with *p*-nitrobenzyl chloride some water must be added to the alcohol. *p*-Azoxybenzylidenaniline forms glistening golden-yellow leaflets, m. p. 185° (uncorr.), very difficultly soluble in ether or alcohol, easily soluble in hot benzene. *p-Azoxybenzylidene-o-toluidine*, $C_{14}H_{10}ON_2(:NC_7H_7)_2$, from *p*-azoxybenzaldehyde and *o*-toluidine, or from *p*-nitrobenzyl chloride, *o*-toluidine and sodium hydroxide, forms glistening orange leaflets, m. p. 182°–183° (uncorr.), very difficultly soluble in alcohol; quite easily in cold, very easily in hot benzene. *p-Azoxybenzylidine-m-toluidine*.—Orange leaflets, m. p. 133° (uncorr.), very easily soluble in cold benzene, very difficultly soluble in hot, absolute alcohol. *p-Azoxybenzylidene-p-toluidine* resembles the *o*- and *m*-toluidine isomers in appearance, but is much less soluble in benzene. It melts at 188°–190° (uncorr.). *p-Azoxybenzaldehyde*, $(ON_2)(C_6H_4.COH)_2$.—The azoxybenzylidene bases just described, decompose with dilute (about 27 per cent.) nitric acid, yielding *p*-azoxybenzaldehyde, which crystallizes from hot glacial acetic acid in yellowish needles, 1-2 cm. long, melting without decomposition at 189°–190.5° (uncorr.), or 194°–195.5° (corr.). This aldehyde dissolves in concentrated sulphuric acid with an orange color, and by heating this solution for an hour at 110°–120° an oxyazo color is produced. M. T. BOGERT.

BIOLOGICAL CHEMISTRY.

On the Nucleoproteids of the Pancreas, Thymus, and Suprarenal Gland, with Especial Reference to Their Optical Activity. BY ARTHUR GAMGEE AND WALTER JONES. *Am. J. Physiol.*, 8, 447–455.—Six preparations obtained from the various glands are described with the methods of isolation employed. All of these substances yield, on hydrolysis, phosphoric acid and purin

derivatives, and are, therefore, to be considered as nucleoproteids in the wide sense of the term. The methods of preparation were such as exclude all dextrorotatory substances that are not of a proteid nature, and all preparations were shown to be free from substances which reduce Fehling's solution, even on prolonged boiling. Yet all of these substances were found to be dextrorotatory, having specific rotations which vary from +37.5°, that of the nucleohiston of the thymus, to +97.9°, that of Hammarsten's nuclein of the spleen. F. P. UNDERHILL.

The Laking of Dried Red Blood-Corpuscles. BY CHARLES CLAUDE GUTHRIE. *Am. J. Physiol.*, 441–447.—The corpuscles used were those of man, the dog, cow, rabbit, chicken and frog. Rapid laking is produced by addition of the animal's own, or the serum of another animal, by addition of aqueous solutions of non-electrolytes and electrolytes except such as readily convert the haemoglobin into insoluble substances. In general, rapidity of laking is in direct ratio to the strength of the solution, to a point approaching saturation, above which the ratio is reversed. Solutions of glycerin lake in proportion to the percentage of water they contain. Chloroform, ether, benzene and xylene produce no laking. Ethyl alcohol containing more than 5 per cent. of water produces a laking proportional to the percentage of water present. The laking action is not essentially affected by varying the temperature between the limits of 25° and —2° C. Dried blood heated at a temperature of 100° C. for twenty minutes is laked by the reagents just as if it had not been heated. The nucleï of dried nucleated red corpuscles are dissolved by solutions which lake the corpuscles. The white corpuscles were observed to behave much like the nucleï of nucleated red corpuscles, except that they are more slowly acted upon than the nucleï.

F. P. UNDERHILL.

A Physiological Study of Nucleic Acid. BY LAFAYETTE B. MENDEL, FRANK P. UNDERHILL, AND BENJAMIN WHITE. *Am. J. Physiol.*, 8, 377–404.—The more important observations recorded in this paper indicate that the vegetable nucleic acid obtained from the wheat embryo resembles, in its physiological effects, the guanylic acid of the pancreas. Introduced in sufficient doses into the circulation, it may produce a fall in arterial pressure; a change in the coagulability of the blood; an increase in the flow of lymph and a change in its composition; and perhaps, also, a degree of immunity toward subsequent injections. The ingestion of nucleic acid is followed in man by an increased output of uric acid, and in the dog by an excretion of allantoïn. These products correspond in either case to only a portion of the purin radicals introduced. In animals, allantoïn excretion was also observed after the introduction of vegetable nucleic acids into the body per rectum, intravenously, intraperitoneally, and sub-

cutaneously. Some features of intermediary purin-metabolism are discussed. F. P. UNDERHILL.

The Action of Acids and Acid Salts on Blood-Corpuscles and Other Cells. BY S. PESKIND. *Am. J. Physiol.*, **8**, 404–430.—This paper gives the observations of the work done in this field, the results of which were published in the *Am. J. Physiol.*, **8**, 99 (see also abstract this Review 25, 42). Further conclusions drawn are that the reagents which precipitate the corpuscles do not penetrate far into them during the reaction, but remain close to the surface and combine with the surface layer. Theoretical considerations, as well as chemical and histological facts brought out in this paper, render the existence of an envelope in mammalian blood-corpuscles highly probable, if not absolutely certain. To explain all the facts, such an envelope must be assumed to contain nucleo-proteid, cholesterin and lecithin. Since leucocytes and probably all typical cells possess the above-mentioned constituents, it seems likely that these substances serve the same purpose in the structure of all these cells, namely, that of forming an envelope.

F. P. UNDERHILL.

The Influence of the H Ion in Peptic Proteolysis. BY WILLIAM J. GIES. *Am. J. Physiol.*, **8**, XXXIV.—The indicators employed were purified fibrin, edestin, and elastin. In equipercentage solutions of acids, whose anions have no precipitative effect on proteid, the relative proteolysis is very different, being greatest in "strong" acids such as hydrochloric, and least in "weak" acids, such as acetic. Equimolar solutions of the same acids gave more concordant results in some respects, although the differences between the effects in such acids as hydrochloric and acetic were still very wide. With equihydric solutions, the results showed greater harmony, though there were still striking divergences. Phosphoric, hydrochloric, nitric, chloric, arsenic, and oxalic acids, in strengths equivalent to decinormal potassium hydroxide, showed practically the same ability to assist pepsin in the digestion of fibrin.

F. P. UNDERHILL.

The Toxicity of Epinephrin (Adrenalin). BY SAMUEL AMBERG. *Am. J. Physiol.*, **8**, XXIII.—The toxicity of epinephrin was tested in experiments on dogs with intravenous, subcutaneous, and intraperitoneal injections. A dose of 2 milligrams per kilo of animal intravenously proved sufficient to kill an animal. One dog with 0.99 milligram per kilo survived. One animal, which had received a dose of 4.9 milligrams per kilo subcutaneously, survived, while one with 6 milligrams per kilo, and others with more, died. The fatal dose by intraperitoneal injections lies, according to Herter, between 0.5 and 0.8 milligram per kilo. Upon the heart, the drug exercises an influence by an initial stimulation

of the vagus, followed by paralysis. It has also a direct injurious effect upon the heart and upon respiration.

F. P. UNDERHILL.

On the Oxidation of Epinephrin and Adrenalin with Nitric Acid. BY JOHN J. ABEL. *Am. J. Physiol.*, 8, XXXI.—Results thus far obtained would indicate that the products obtained in the oxidation of epinephrin, $C_{10}H_{11}NO_3$, and adrenalin are identical. These products are oxalic acid and a hygroscopic, crystalline salt of a nitrogenous base which the author has called a coniine-piperidine-like body, on account of its peculiar, offensive, and penetrating odor. F. P. UNDERHILL.

On the Influence of Camphor Ingestion upon the Excretion of Dextrose in Phlorhizin Diabetes. BY H. C. JACKSON. *Am. J. Physiol.*, 8, XXXII.—According to all former investigators, there is in phlorhizin and pancreatic diabetes a certain definite ratio between the amount of dextrose and nitrogen eliminated in the urine. This D : N ratio is 2.8 : 1 in all cases except that of the dog in phlorhizin diabetes when it is 3.75 : 1. The feeding of camphor to a dog made diabetic with phlorhizin, and upon which the relation 3.75 : 1 had been obtained, immediately decreased the D : N ratio to 2.8 : 1, or equal to that prevailing in all other animals with phlorhizin, and in the dog with pancreatic diabetes. Camphor changes the character of certain of the kidney cells and these refuse to functionate so that the amount of sugar to nitrogen in the urine is decreased as a result. F. P. UNDERHILL.

On the Elementary Composition of Adrenalin. BY JOHN J. ABEL. *Am. J. Physiol.*, 8, XXIX.—The composition of adrenalin varies in respect to each of the elements, carbon, hydrogen and nitrogen. The extremes in respect to each element run from

$$C = 56.53 \text{ to } 58.89$$
$$H = 4.77 \text{ to } 7.19$$
$$N = 7.59 \text{ to } 10.65 \text{ (Dumas.)}$$

It is, therefore, evident that adrenalin cannot yet be spoken of as having a "constant composition" (Takamine), and as being a purely chemical individual. F. P. UNDERHILL.

On the Behavior of Extracts of the Suprarenal Gland toward Fehling's Solution. BY JOHN J. ABEL. *Am. J. Physiol.*, 8, XXX. —A purified aqueous extract of both beeves' and sheep's suprarenal glands, if poured into an excess of boiling Fehling's solution (Fehling 1 to water 0.5), and the mixture kept at the boiling-point for two minutes and then cooled, no cuprous oxide or cuprous hydroxide separates out. After boiling from five to six minutes, a considerable reduction occurs, and after boiling fifteen minutes, the reduction appears to have reached a maximum, and a heavy deposit of yellow cuprous hydroxide, with possibly a small admixture of cuprous oxide, is obtained.

F. P. UNDERHILL.

Salivary Digestion in the Stomach. By W. B. Cannon and H. F. Day. *Am. J. Physiol.*, **8**, XXVIII.—The experiments, which cannot be given here, show that at the end of an hour the sugar present in the cardiac contents averages almost twice that present in the pyloric contents, and may be two and a half times as much. When the food is liquid, the ratio is diminished, *i. e.*, it is about six to five instead of two to one. Also when small amounts of food are given, the sugar content is about the same in both parts of the stomach. Two cases in which the stomach was massaged at intervals during digestion showed a larger amount of sugar in the pyloric end than in the cardiac end. The largest amount of sugar, estimated as maltose, which has been found in the stomach contents, is about 49 per cent. Cats were employed for experimentation. F. P. Underhill.

Further Observations on Skatosin. By Robert E. Swain. *Hofmeister's Beiträge*, 3, 442–446.—The present article deals with the elementary composition of skatosin, the substance isolated by Baum from the autolysis of pancreas. In confirmation of the work of Baum, Swain finds that skatosine chloride has the following elementary composition:

C. Per cent.	H. Per cent.	N. Per cent.	Cl. Per cent.	O. Per cent.
39.23	6.29	9.31	34.77	10.40

corresponding to the formula $C_{10}H_{16}N_2O_2$ for skatosin.
F. P. Underhill.

A New Method for the Determination of Ammonia in the Urine and Other Animal Fluids. By Otto Folin. *Ztschr. physiol. Chem.*, 37, 161–177.—The preformed ammonia of the urine may be determined as follows: 25 cc. of urine are placed in a cylinder (height about 45 cm. and diameter about 5 cm.) and to it are added 8–10 grams of sodium chloride, 5–10 cc. of petroleum or toluene, and 1 gram of dry sodium carbonate. Air is led through the urine by means of a suction-pump until all the ammonia has been driven off, which takes from one to one and a half hours, at a temperature of 20°–25° C. with the employment of 600–700 liters of air per hour. The air containing the ammonia is led into two vessels containing tenth-normal acid. The ammonia content of the urine is obtained by titrating the remaining acid, using alizarin-red as an indicator. With certain modifications, the same method may be employed in the determination of the ammonia content of the blood. F. P. Underhill.

The Preparation of Benzoyl-Acetyl Peroxide and Its Use as an Intestinal Antiseptic in Cholera and Dysentery. By Paul C. Freer. Bureau of Government Laboratories, Manila, P. I., 1902, No. 2.—Benzoyl-acetyl peroxide may be regarded as hydrogen peroxide in which one-half the hydrogen has been substituted by the benzoyl group and the other half by acetyl. It is in

itself inert (Freer and Novy, *Am. Chem. J.*, 27, 163), and its value as a germicide appears only after hydrolysis. On hydrolysis there is formed aceto-peracid, which remains in solution, and dibenzoyl peroxide which separates as a crystalline powder. The germicidal properties of the solution are due to the presence of aceto-peracid, with small quantities of benzo-peracid. The same hydrolysis takes place in the intestine and the resulting germicidal aceto-peracid has its local effect. In the cholera hospitals at Manila, better results were obtained by the administration of this substance than with any other remedy. With dysentery, also, its use was very successful. Administration was made per os with weak solutions, or in capsules, and per rectum with high injections. F. P. UNDERHILL.

I. A *Study* of Some of the *Salts* Formed by Casein and Paracasein with Acids: Their Relations to American Cheddar Cheese. BY LUCIUS L. VAN SLYKE AND EDWIN B. HART. *Am. Chem. J.*, 28, 411–438.—The object of the work described in this paper is to study the real functions of acids in relation to the important changes taking place in cheese curd during the cheddar process of cheese-making. In examining cheese for heterocaseose, by extraction with a dilute solution of common salt, a body was found in quantities so large as to indicate that it was some compound other than heterocaseose. In studying cheese made with, and without, the use of lactic acid, the salt soluble product was discovered to be present in very large quantities only when acid was used, being practically absent, or present, in very small proportions, when no acid was used. In normal cheese, the salt-soluble product is always found, but in varying quantities, being largest in new cheese and diminishing as the cheese ages. Various conditions affect the amount in new cheese, especially those conditions influencing the amount of acid present. Paracasein, carefully prepared and treated with dilute lactic acid, furnishes a product resembling in both physical and chemical properties the salt-soluble substance extracted from cheese. Paracasein is shown to combine with an acid in at least two different proportions, forming two distinct compounds: one is the unsaturated or mono-acid salt, the other is the saturated or di-acid salt. Such compounds were prepared with lactic, acetic, hydrochloric, and sulphuric acids. Casein forms salts with acids in the same manner as paracasein. The unsaturated salts formed by casein and paracasein with acids are soluble in dilute solutions of sodium chloride in hot 50 per cent. alcohol. Both forms are sparingly soluble in dilute solutions of calcium carbonate and calcium lactate. The important changes taking place in cheese curd during the process of cheddar cheese-making, such as the acquired ability to form strings on hot iron, the changes in appearance, plasticity and texture, and probably the shrinking, are due to the formation

of the unsaturated paracasein lactate. The ripening process in normal cheddar cheese, by which the insoluble nitrogenous compounds change into soluble forms, begins not with paracasein, as has been universally held, but with unsaturated paracasein lactate. The water-soluble nitrogen in cheese generally increases as the unsaturated paracasein lactate decreases, and apparently at the expense of the latter compound. The first step in the normal ripening process of American cheddar cheese is probably a peptic digestion of unsaturated paracasein lactate. Some of the facts presented suggest a method of proof of the commonly accepted theory of gastric digestion. F. P. UNDERHILL.

II. Methods for the Estimation of the Proteolytic Compounds Contained in Cheese and Milk. BY LUCIUS L. VAN SLYKE AND EDWIN B. HART. *Am. Chem. J.*, 29, 150–171.—In this paper, analytical methods are given for the determination of the various nitrogenous compounds of cheese and milk.

F. P. UNDERHILL.

An Experimental Study of Lithium. BY CLARENCE A. GOOD. *Am. J. Med. Sci.*, 125, 273–284.—Lithium is excreted in the saliva, into the stomach and bowel, and in the urine. The greater part is excreted in the urine, though more appears in the stomach and bowel when nausea, vomiting, and diarrhoea have been profuse. It can usually be demonstrated in the secretions within ten minutes after a hypodermic injection, though its excretion proceeds slowly, having been found in the secretions twenty-three days after the injections had been stopped. Lithium salts given to animals, hypodermically or by the stomach, cause, sooner or later, fatal gastro-enteritis. This condition is undoubtedly connected with the excretion of the metal through the bowel wall. Lithium salts do not possess any diuretic action that cannot be accounted for by their salt action. They render the urine alkaline and thus act like other alkalies. Dilute solutions of lithium salts are not solvents for uric acid or urates.

F. P. UNDERHILL.

An Address on Chemical Pathology: The Field of Greatest Promise in Pathological Research. BY G. W. MCCASKEY. *N. Y. Med. J.*, 77, 90–94.—Being a résumé of some of the latest investigations in the field of chemical pathology.

F. P. UNDERHILL.

A New Method of Hemo-Alkalimetry and a New Hemo-Alkalimeter. BY ARTHUR DARE. *Phila. Med. J.*, 11, 137–142. —In this article a new method for determining the alkalinity of the blood is given with drawings and explanation of a new form of blood alkalimeter. The method depends upon the spectroscopic properties of the hemoglobin of the blood, and cannot be given here. F. P. UNDERHILL.

The Action of Ethyl-Alcohol on Contractile Protoplasm. By FREDERIC S. LEE. *Am. J. Physiol.*, **8**, XIX.—The spontaneous contractions of the bell of the medusa, *gonionema*, are markedly increased in number by small quantities of ethyl alcohol in sea-water. This increase becomes progressively greater with solutions ranging from $^1/_{16}$ per cent. to $^1/_4$ per cent.; then progressively less, until with about 2 per cent., the contractions are nearly normal in number; with stronger alcohol they are irregular, feeble, and partial. Concentrated sea-water acts like weak alcohol, but the amount of concentration that is required in order to produce a given increase in the rate of contraction is so great as to preclude the idea that abstraction of water from protoplasm is the important causative factor in the favorable action of alcohol.

F. P. UNDERHILL.

On the Cleavage of Proteids with Bacteria. By ALONZO ENGLEBERT TAYLOR. *Ztschr. physiol. Chem.*, **36**, 487–493.—Experiments made with casein and the two bacteria, *B. coli communis* and *Proteus vulgaris* show that the first organism does not act very energetically upon casein. The action of *Proteus vulgaris* is profound, decomposing the proteid into such cleavage products as histidin and lysin, and probably yielding also a small amount of tyrosin. F. P. UNDERHILL.

Some Observations on the Coagulation of Milk. By A. S. LOEVENHART. *Am. J. Physiol.*, **8**, XXXV.—There is a stage in the rennin coagulation of milk when boiling causes a coagulum to separate. The milk acquires the property of yielding a heat coagulum before there is any apparent alteration in the consistency of the milk. This represents a stage in coagulation of milk whether the rennin be of gastric or pancreatic origin. This heat coagulation has been termed by Roberts the "metacasein reaction," and it may be prolonged by any agency partially fixing the calcium salts, as by boiling, adding small amounts of ammonium oxalate, etc. F. P. UNDERHILL.

On the Cleavage of Gelatine. By P. A. LEVENE. *Ztschr. physiol. Chem.*, **37**, 81–86.—This article deals with the determination of the content of glycocoll in gelatoses obtained from peptic, tryptic, and papaïn digestions of pure gelatin. From the following tables it is seen that the gelatoses have a greater content in glycocoll than gelatin itself:

	Per cent.
Gelatin	16.43
Proto-peptogelatose	18.36
Proto-tryptogelatose	17.07
Proto-papaiogelatose	20.29
Deutero-peptogelatose	19.96
Deutero-tryptogelatose	20.29
Deutero-papaiogelatose	19.33

F. P. UNDERHILL.

Is the Action of Alcohol on Gastric Secretion Specific? By George B. Wallace and H. C. Jackson. *Am. J. Physiol.*, **8**, XVII.—Experiments were performed with the object of determining whether the flow of gastric juice caused by the introduction of alcohol into the intestine is due to a purely reflex action, and further, whether it is an effect produced by irritant substances other than alcohol. Dogs were employed. The conclusions are that alcohol introduced into the intestine stimulates the gastric secretions not through its absorption and subsequent action on the gastric mucosa, but by a purely reflex action, and that this action is not limited to alcohol, but is possessed by other irritant substances, such as oil of peppermint.

F. P. Underhill.

A Preliminary Report on the Pharmacological and Chemical Properties of the Tri-Brom-Tertiary-Butyl-Alcohol. By E. M. Houghton and T. B. Aldrich. *Am. J. Physiol.*, **8**, XVIII. —This compound when administered in various ways to animals possesses decided anaesthetic properties; recovery from small quantities takes place without any apparent untoward results. The drug appears to have very little action upon the heart or circulation, as shown by myocardiographic and blood-pressure tracings taken from curarized animals. The name brometone is suggested for the compound. F. P. Underhill.

New Experiments on the Physiological Action of the Proteoses. By Lafayette B. Mendel and Frank P. Underhill. *Am. J. Physiol.*, **8**, XVI.—A number of preparations of proteoses have been made under conditions which would exclude, so far as possible, the presence of the specific contaminating tissue substance (peptozyme) assumed by Pick and Spiro to be the toxic factor when proteoses are introduced into the circulation. The number includes native proteoses separated directly from the wheat embryo, hemp seed, and Brazil nut without the use of foreign enzymes or acids; proteoses prepared by the action of superheated water or of dilute acids on crystallized proteids; proteoses prepared by the digestion of edestin and casein with the vegetable enzymes paperin and bromelin; products purified by the methods of Pick and Spiro. All of these proteose preparations, introduced into the circulation of dogs in doses of 0.3 to 0.5 gram per kilo of body weight, have provoked the characteristic symptoms noted in our earlier work (*Am. J. Physiol.*, 1899, **2**, 142), namely, a fall in arterial pressure, diminished coagulability of the blood, a transitory stage of excitation followed by narcosis, a degree of immunity and (in the single experiment thus far tried) lymphagogic effects. F. P. Underhill.

On the Origin of Glycuronic Acid. By J. A. Mandel and H. C. Jackson. *Am. J. Physiol.*, **8**, XIII.—This article shows

that contrary to current opinions the origin of glycuronic acid in the body is to be sought in the proteid, and not in the carbohydrate molecule. Further experiments make it probable that the ascending loops of Henle in the kidney and not the convoluted tubules are concerned in the synthesis of the glycuronates.

F. P. UNDERHILL.

Further Studies of the Toxic and Antitoxic Effects of Ions. BY JACQUES LOEB AND WILLIAM J. GIES. *Am. J. Physiol.*, 8, XIV.—This research has confirmed Loeb's original observation that each electrolyte in solution at a certain concentration is able to prevent the development of the fundulus egg after fertilization, and also to destroy the egg. Confirmation was also received of the fact that this poisonous action can be wholly or partly inhibited by the addition of a proper amount of another electrolyte. New evidence is shown that the degree of antitoxic influence exerted by the second electrolyte increases with the valency of the cation. The antitoxic action of bivalent cations was found to be very much greater than that of univalent cations. The antagonistic power of trivalent cations is considerably greater than that of the bivalent, with certain exceptions. Solutions of non-electrolytes, such as solutions of urea, cane-sugar, glycerin, and alcohol, have nó antitoxic influence except under conditions which favor the formation of not easily soluble dissociable compounds with the electrolyte, whereby the concentration of the toxic ion is considerably reduced. F. P. UNDERHILL.

A Proteid Reaction Involving the Use of Chromate. BY WILLIAM J. GIES. *Am. J. Physiol.*, 8, XV.—Solutions of mono- and divalent cations (the only ones thus far employed) cause no precipitates in neutral or alkaline proteid fluids, but on further treatment with small amounts of dilute acids flocculent precipitation of a proteid-chromate compound occurs in every case. The reaction is especially striking with such bodies as gelatin and proteose (the precipitates with these disappearing on warming and reappearing on cooling) and it seems to be more delicate than the acetic acid and potassium ferrocyanide test. Further study is expected to give the explanation for the reaction.

F. P. UNDERHILL.

On Glucophosphoric Acid. BY P. A. LEVENE. *Am. J. Physiol.*, 8, XI.—Levene analyzed the phosphorus-containing substance in many seeds, first obtained by Paladin and analyzed by Schulze and Winterstein. These authors failed to establish the nature of the organic radical of the substance. The author found that about 30 per cent. of the organic part could be split off in the form of a carbohydrate which gave all the qualitative tests of a pentose. The substance contained about 15 per cent. of organic phosphorus, 1.8 per cent. of nitrogen, and 50 per cent. of

ash, which consisted chiefly of calcium magnesium phosphate. The substance contained no glycerin or purin bases.

F. P. UNDERHILL.

On Nucleic Acid. BY P. A. LEVENE. *Am. J. Physiol*, 8, XII. —This author continues his analysis of some nucleic acids. From the acids of the pancreas and spleen there was obtained, in the form of a picrate, a substance which could be transformed into a disulphate. The composition of the two salts was as follows: For the picrate—

	Calculated. Per cent.	Found. Per cent.
C	35.07	35.56
H	2.64	2.91
N	24.65	25.11

For the sulphate—

	Calculated. Per cent.	Found. Per cent.
C	29.90	29.44
H	4.34	4.01
N	26.16	26.25
S	9.62	9.84

In its elementary composition the substance is not unlike crytosin, as described by Kossel. The formula for episarkin, however, seems to correspond better with the analytical data. It is, perhaps, an amino oxypyrimidine. F. P. UNDERHILL.

Further Mucoid Studies. BY WILLIAM J. GIES. *Am. J. Physiol.*, 8, XIII.—Investigations into the distributions of osseomucoid indicate that glucoproteid is a normal constituent of all bones. Connective tissue mucoid shows a tendency to combine with other proteids. Acidification of tissue extracts is not sufficient for complete precipitation of the mucoid. Precipitated mucoid shows practically no combining power with acids. The blood serum of a rabbit, which has been treated with several subcutaneous and intraperitoneal injections of neutral solutions of potassiomucoid, produced precipitates in neutral and slightly acid solutions of the latter proteid substance. F. P. UNDERHILL.

How Long Does (Arbacia) Sperm Live in Sea-Water? BY MARTIN H. FISCHER. *Am. J. Physiol.*, 8, 430–435.—The experiments here recorded show that the spermatozoa of the sea-urchin (*arbacia*) live from 48 to at least 133 hours after being shed into sea-water. F. P. UNDERHILL.

On Glucothionic Acid. BY P. A. LEVENE. *Am. J. Physiol.*, 8, 11.—In the preparation of nucleic acid by the picric acid-alcohol method, a carbohydrate is precipitated with the acid. The carbohydrate can be removed by copper chloride. In the yeast, in bacteria, pancreas, and liver, the carbohydrate resembled glycogen. In the spleen, it had properties similar to those of chondroitin sulphuric acid. It contained sulphuric acid in organic

combination, and gave the barium test for glycuronic acid. It differs from chondroitin sulphuric acid in its behavior towards orcin-hydrochloric acid. It has been given the name of glucothionic acid and it is possible that the substance is not unlike the glucosaminic acid described by Fischer, combined with sulphuric acid. F. P. UNDERHILL.

On the Biological Relation of Proteids and Proteid Assimilation. BY P. A. LEVENE AND L. B. STOOKEY. *Am. J. Physiol.*, 8, XXIII.—In applying the precipitin test, the authors observed that different proteids of a given animal, and perhaps of a given species, possess a certain similarity which distinguishes them from all the proteids of any other origin. This biological individuality of proteids could serve to explain the cause of the fact that proteid material ingested has to be broken up by the organism before it is utilized. The molecule of foreign proteid material has to be reconstructed into the molecule characteristic of the given animal. An attempt was also made to determine the place of the breaking-down of the ingested proteid, and application of the precipitin test was made. This part of the work is not yet complete. F. P. UNDERHILL.

On the Digestion of Gelatin. BY P. A. LEVENE AND L. B. STOOKEY. *Am. J. Physiol.*, 8, XXIII.—In order to gain some light upon the process of transformation of gelatin into gelatoses, the authors investigated the formation of free ammonia in the course of tryptic digestion of gelatin, and observed that the free ammonia increases as the gelatin is transformed into the primary, and the primary into the secondary gelatoses. F. P. UNDERHILL.

INDUSTRIAL CHEMISTRY.

Purity of So-called Standard Drugs and Chemicals. BY VIRGIL COBLENTZ. *J. Soc. Chem. Ind.*, December 15, 1902.—Professor Coblentz, in his address as chairman of the New York Section of the Society of Chemical Industry, reviews the results of himself and others in the examination of some of the well-known drugs and chemicals as now found in the American market. *Hydrochloric*, *sulphuric* and *nitric acids* sold as either "C. P." or "U. S. P.," he finds to be of a high degree of purity, practically all of them standing the Berzelius-Marsh test for arsenic for at least fifteen minutes. The commercial acids are excellent also so far as the presence of arsenic is concerned, although they contain metallic impurities. *Boric acid* is frequently found mixed with as much as three times its weight of powdered borax. Some lots also contained calcium sulphate and calcium borate. *Chromium trioxide* is found almost invariably with adhering sulphuric acid amounting, in cases reported, to 5 per cent., and all samples examined by Coblentz were found to

contain more or less alkali acid sulphate. *Citric acid.*—Most, if not all the samples offered, contained iron and lead, although the quality has improved in recent years. *Oxalic acid* has been found on the market mixed with the cheaper magnesium sulphate, one case reported containing as much as 80 per cent. of this salt. *Salicylic acid* has been met with, adulterated with starch and calcium sulphate. It is rarely chemically pure. *Tannic acid* is found extensively adulterated with such substances as dextrin, sugar, flour, salt, etc. The author found samples yielding varying quantities of ash up to 15 per cent. and the presence of dextrin was of very frequent occurrence. *Acetic ether* rarely conforms to the standard requirements of 98.5 per cent. Most samples vary from 30 to 60 per cent. A sample sold as "absolute" was reported as containing 86 per cent. of the pure ether. *Ammonium chloride.*—The powdered salt contains frequently considerable quantities of powdered ammonia alum, also clay has been found in various samples. *Antimony sulphide (native).*—This is extensively adulterated with chalk, sand, clay, and the like, colored with charcoal. *Antipyrin.*—This is frequently substituted by dispensers with the cheap and dangerous antipyretic acetanilide. *Aristol.*—This most valuable and popular antiseptic of recent years is very largely adulterated, either designedly or as the result of efforts to make the dithymol-diiodide, which is then collected and dried without washing or purifying, so that excess of alkali and free iodine are found to be present, although gross adulterants like starch, talc, calcium carbonate, zinc oxide, tripoli and boric oxide have been found in some cases. *Borax.*—Powdered borax, particularly that offered in package form, is extensively adulterated and even entirely substituted by sodium bicarbonate. Even bulk goods have been found to contain, 6, 38, 44, and 60 per cent. of pure borax, the balance consisting of soda. *Bismuth salts.*—All contain more or less traces of copper, arsenic, and iron, with occasionally lead and tellurium. *Bromine.*—Reports show that the American article contains 3.4 to 5.2 per cent. of chlorine, while the German contains but 0.53 to 0.68 per cent. Naturally all American-made bromides contain large amounts of chlorides. *Calcium carbonate (precipitated).*—Samples containing as much as 50 per cent. of magnesium carbonate have been reported. *Calcium phosphate (precipitated).*—This is frequently adulterated with powdered chalk, gypsum, or talc to the extent of 30 per cent. *Creosote (Beechwood).*—The majority of commercial wood creosotes are reported to consist either of low- or high-boiling products with little or no guaiacol, the most valuable component. The use of impure phenol as a substitute for wood tar creosote under the name of "coal tar creosote" is also noted. A Massachusetts analyst reports that 40 per cent. of the samples sold as creosote are impure phenol. *Glycerin.*—Langmuir, in 1899, and Patch, in 1897, had reported that all samples of "C. P."

glycerin, either foreign or domestic, respond to the tests for arsenic. Coblentz found that one sample of American manufacture contained about 1 part of arsenious oxide to 70,000, while another averaged 1 to 100,000. *Hypophosphites.*—These salts vary much in quality, arsenic, phosphites, and phosphates being found in nearly all samples. *Iron, reduced.*—This is rarely of satisfactory quality, usually containing excessive quantities of sulphide and appreciable amounts of arsenic. Moreover, the percentage of metal varies from 13 to 83 per cent., both ferrous oxide and ferric oxide being found to be present. *Lead oxide* (*litharge*).—Lead carbonate to the extent of 20 per cent. and silicious matter colored with ferric oxide and ochre have been found. *Potassium hydroxide.*—Recent analysis shows the percentage of hydroxide to vary from 88.5 to 90 with 1 to 3 per cent. of sodium hydroxide and but little more than traces of carbonate. The *best* qualities of lump potash, purchased in drums, were found to average about 86 per cent. of pure hydroxide. *Potassium bromide.*—As mentioned under bromine, the American bromides all contain chloride varying from 4.5 to 9 per cent. *Potassium chlorate.*—The admixture of pulverized alum with pulverized chlorate is of very common occurrence. *Potassium bitartrate* (*cream of tartar*).—While this chemical is easily obtained of a high degree of purity, it is still extensively sophisticated. Mixtures of alum, bitartrate and calcium phosphate and of ammonia alum and bitartrate will not show the true strength of bitartrate by cold titration, but if ignited and the ash titrated with a normal acid, after having been extracted with water and filtered, the adulteration is shown. *Potassium iodide.*—This chemical rarely conforms to the standard of 99.5 per cent. purity demanded by the U. S. P. As much as 8 per cent. of chloride has been found, as well as excess in alkalinity at times. Iodate is to be found in nearly all the samples of iodide. *Phenacetin.*—This most popular antipyretic is quite extensively substituted by the cheap and dangerous acetanilide or mixtures of this with sugar or sodium bicarbonate. *Phosphorus.*—Arsenic has been found in all samples examined, even as high as 1 per cent. It is reported that the phosphorus made by the electric furnace, however, is free from this dangerous contamination. *Sodium phosphate.*—Examination of both English and American manufacture has shown the presence of arsenic, in the former case, in dangerous quantities. *Sulphonal.*—This extensively used hypnotic is often substituted by sodium bicarbonate or a mixture of this with acetanilide which is a dangerous substitute, considering the large doses in which sulphonal is administered. *Salophen.*—This is frequently found substituted by a mixture of acetanilide and sodium salicylate, the action of which is quite different. *Tartar Emetic.*—This contains amounts of arsenic varying from traces to appreciable quantities. 40 to 70 per cent. of potassium sulphate was found in five sam-

ples purchased from English wholesalers. *Thymol.*—The high price of this antiseptic has led to sophistication with borax crystals and paraffin cut into pieces to imitate the thymol crystals. *Vanillin.*—This relatively expensive chemical has been found admixed with acetanilide to the extent of 50 per cent. Benzoic acid has also been found as an adulterant. The writer enters a strong plea for a National Pure Food and Drug Law, such as was introduced into Congress under the name of the Hepburn bill.

S. P. SADTLER.

Process for Rendering Phosphoric Acid Available. BY CHARLES BASKERVILLE, PH.D. *J. Soc. Chem. Ind.*, December 31, 1902.—The author, after endeavoring to secure a mechanical method for concentrating the phosphatic pebble of North Carolina, but without satisfactory results, tried the method of fusing the ground material with alkaline sulphates, sulphides, nitrates, and carbonates. Jigged material which contained 35 to 44 per cent. of tricalcium phosphate was taken. The use of nitrates gave the largest percentage of citrate-soluble phosphoric acid, but the expensive nitrogen was driven off. So carbonate was taken. The pulverized material in the proportion of one of carbonate to four of the crude phosphate rock, was subjected to a good red heat until there was slight sintering but no fusion. The product is easily removed from the furnace in a porous condition somewhat like pumice stone and readily ground. It does not attract moisture. From 75 to 90 per cent. of the phosphoric acid was rendered available, depending upon temperature and upon the duration of the time of heating. The percentage of water-soluble phosphate was not notably increased. S. P. SADTLER.

Antiseptics and Their Use in the Preservation of Food. BY SAMUEL S. PRESCOTT. *Tech. Quart.*, December, 1902.—The author in an address before the Atlantic States and Western Canned Food Associations speaks first of the nature of the changes which bring about the fermentation, putrefaction and decay of foods and then of the methods of food conservation which are grouped under four heads: Cold storage; preserving, pickling and drying; canning; and the use of antiseptics. The conditions of application of each of these methods are then detailed and the degree of protection against change stated. Of these several methods, the author indicates the greatest value to attach to canning, as this can be combined with such a heating as to effectually sterilize the material and allow of its indefinite protection. In speaking of antiseptics or preservatives, the writer states that the number of such substances in common use for foods is relatively small. From authoritative analyses of 67 preservatives, it was found that 33 contained either borax or boric acid as the most active constituent, 10 contained sulphites, 8 salicylic acid or its sodium salt, and 7 benzoic acid or its sodium com-

pound. All of the preservatives commonly used can be easily detected by the skilled chemist, despite statements sometimes made to the contrary. The author gives a review of the recent testimony of medical authorities as to the poisonous or non-poisonous character of some of these preservatives such as boric acid for instance and finds it so conflicting as to leave the question at present undetermined. The report of the committee recently appointed by the British Government to investigate the use of preservatives in foods is, on the whole, unfavorable to the use of preservatives. S. P. SADTLER.

Estimates of the Sugar Crop of the World for 1902–1903. U. S. Consular Report, January, 1903.—

I. From the sugar beet:

	1902–1903. Tons.	1901–1902.	1900–1901.	1899–1900.	1898–1899.
Germany	1,950,000	2,299,408	1,984,186	1,798,631	1,721,718
Austria	1,025,000	1,302,038	1,094,043	1,108,007	1,051,290
France	880,000	1,183,420	1,170,332	977,580	830,132
Russia	1,275,000	1,110,000	918,838	905,737	776,066
Belgium	240,000	300,000	333,119	302,865	244,017
Holland	125,000	203,172	178,081	171,029	149,763
Other countries	355,000	400,000	367,919	263,919	209,115
Total	5,850,000	6,843,038	6,046,518	5,518,048	4,982,101

II. From the sugar-cane:

	1902–1903. Tons.	1901–1902.	1900–1901.	1899–1900.
Cuba	850,000	683,312	512,061	281,420
Porto Rico	95,000	82,179	55,089	32,751
United States	425,000	400,000	350,000	267,734
Other countries	2,100,000	2,197,114	2,127,251	1,894,152
	3,470,000	3,362,605	3,044,401	2,476,057
III. Old stocks	1,800,000	964,042	609,848	928,240
Combined total	11,120,000	11,169,685	9,700,767	8,922,335

S. P. SADTLER.

AGRICULTURAL CHEMISTRY.

Fruits and Fruit Products. BY L. S. MUNSON, L. M. TOLMAN, AND B. J. HOWARD. *U. S. Dept. Agr., Bureau of Chem. Bull. No. 66*, pp. 114.—The primary object of the extended investigations reported in this bulletin was to determine the character of the fruit products on the market. The attempt was made to secure a thoroughly representative collection and to this end samples of all grades of jams, jellies, and similar preparations on sale at selected stores in the cities of Washington, New York, Philadelphia, and New Orleans were obtained. For purposes of comparison, numerous additional analyses were made of fresh fruits, fruit juices, and jellies and jams made in the laboratory. The bulletin was prepared under the direction of W. D. Bigelow, chief of the food laboratory.

The chemical work was done by Munson and Tolman. The methods of analysis used are given in full. The authors discuss the addition of glucose, preservatives, starch, coloring-matter, gelatinizing agents, artificial sweetening materials, and foreign fruits to commercial fruits products, and the presence of heavy metals in products preserved in tin receptacles. The substitution of glucose for the more expensive sugars was found extensively practiced. Of 214 samples examined, 110 contained glucose. The better class of these samples contained as low as 10 per cent. of glucose, while some of the cheaper grades were composed almost entirely of this material. A brief account of the manufacture and composition of glucose is included. The preservatives most commonly found were salicylic and benzoic acids or their sodium salts. In jellies and jams they were present in more than one-half of the samples examined, while in canned fruits they were usually absent. Their use was most extensive in fruit products put up in glass jars and not hermetically sealed. Starch was apparently added in the manufacture of some of the cheaper grades of jellies. Many pure apple jellies were found to show no starch reaction whatever. Hence it is considered that the absence of starch in any jelly cannot be taken as evidence that apples were not used as a basis. The use of apples or apple juice for giving jellies proper consistency is believed to be very extensive. Gelatin and agar were not detected in the samples examined. In 25 samples of fruit products put up in tin cans, tin was absent in only one sample and present in quantities ranging from 41 to 1,259 milligrams per kilogram of material in the remaining samples. Zinc was present in 13 of the 25 samples, the maximum quantity being 108 milligrams per kilogram.

Analytical data are given for 27 samples of fresh fruits and fruit juices, 23 of jams and jellies prepared in the laboratory, and also of the fruits and juices from which they were made, and for samples of commercial products as follows: Jams 86, jellies 44, canned fruits 74, brandied fruits 7, fruit butter 3, and solid marmalades 3. The average analyses of the fresh fruits and fruit juices are given in part in the table below:

COMPOSITION OF FRUITS AND FRUIT JUICES.

	Total solids. Per cent.	Ash. Per cent.	Acidity as H_2SO_4. Per cent.	Protein ($N \times 6.25$). Per cent.	Reducing sugar. Per cent.	Cane-sugar. Per cent.
Blackberry	12.69	0.585	0.638	0.919	4.67	0.16
Blackberry juice	7.30	0.382	0.704	0.246	...	....
Cherry	12.64	0.602	1.627	0.650	6.84	none
Cherry juice	....	0.553	1.465	0.388	....	....
Currant	12.97	0.602	1.546	1.369	3.44	none
Currant juice	6.71	0.454	1.642	0.300	....	....
Black raspberry	20.32	0.812	0.774	1.212	6.[illegible]9	none
Black raspberry juice	11.60	0.687	0.794	0.253	7.56	none
Red raspberry	13.28	0.539	1.104	0.975	3.52	0.80
Red raspberry juice	6.98	0.517	1.120	0.397	3.64	....
Strawberry	8.74	0.619	0.915	0.588	3.22	0.46
Strawberry juice	6.12	0.492	0.834	0.116	3.30	0.23

Of the commercial products, 53 samples of jams and 13 of jellies contained glucose but were not so labeled, and of these 33 were artificially colored. Of the remaining jams and jellies, 27 were purchased as compounds. No adulterants were detected in the brandied fruits. The alcohol content of 4 samples was about 17 per cent. In general, the adulterants found in the products examined are considered as subject to criticism on the ground of deception rather than because of their being prejudicial to health. The analyses of the adulterated products were submitted to the manufacturers before publication and their replies in substance are incorporated in the bulletin.

The microscopical examination of fruits and fruit products is discussed by Howard, plates from photographs and drawings illustrating histological characteristics of several fruits being appended. H. W. LAWSON.

Food Adulteration. BY F. W. TRAPHAGEN. *Mont. Agr. Expt. Sta. Bull. No. 38*, 24 pp.—In this bulletin are given the results of examinations of over 200 samples of canned soups, tomato catsups, jams, jellies, and preserves, cereal breakfast foods, baking-powders, vinegars, and other products on sale in the state. In tests made at the station during the past year, the author states that salicylic acid in extremely small quantities has been found almost constantly present in fresh fruits (see this Journal, **25**, 242). The distribution of benzoic acid in fruits and vegetables is also being investigated. H. W. LAWSON.

The Chemical Composition of Food Preservatives. BY J. B. WEEMS AND I. J. MEAD. *Ia. Agr. Expt. Sta. Bull. No. 67*, pp. 259–265.—The authors have collected and analyzed a number of mixtures sold under proprietary names as food preservatives. A brand called "A" was found to consist of 34 per cent. of sodium chloride and 66 per cent. of borax. A brand sold as a milk preservative and designated "M" was found to consist of 20 per cent. of borax and 80 per cent. of boric acid. "Preservaline Butter Powder," sold at 50 cents a pound, proved to be ordinary cooking soda. An analysis of "Freezine" showed a 5.47 per cent. solution of formaldehyde. The price of this material was $1 per quart. "Cider and Fruit Preservative," offered at $1.75 per pound, proved to be salicylic acid. "Cream Albuminoid" claimed "to give cream that much-desired rich and heavy substance which it frequently lacks," was found to consist of 15 per cent. of borax, 25 per cent. of boric acid, and 60 per cent. of gelatin. The extravagant claims of the producers of many of such substances are quoted. H. W. LAWSON.

Solutions for Testing Cream and Milk. BY J. B. WEEMS AND C. E. GRAY. *Ia. Agr. Expt. Sta. Bull. No. 67*, pp. 266–272.—Suggestions are made concerning the use of standard solutions by

dairymen in testing the acidity of milk and cream. Solutions prepared from alkaline tablets sold for this purpose were found to have strengths from 12.4 to 14.8 per cent. greater than a tenth-normal solution. Repeated freezing and thawing of a tenth-normal solution produced no change in its strength. Observations are given on the change in strength of standard solutions exposed to the atmosphere. Lime-water prepared at temperatures of about 66° F. had a strength of about 45 per cent. of a tenth-normal solution. H. W. LAWSON.

The Exact Calculation of Balanced Rations. BY J. T. WILLARD. *Kans. Agr. Expt. Sta. Bull. No. 115*, pp. 97–146.—The author's method, which is based upon the balancing of feeding-stuffs two by two by the principles of alligation, is described in detail, and tables are given showing the digestible ingredients in feeding-stuffs, feeding standards, nutritive ratios of different feeding-stuffs with factors for determining the number of pounds required to furnish 1 pound of protein, and over 2,100 balanced mixtures each consisting of two materials. H. W. LAWSON.

Experiments on the Metabolism of Nitrogen, Sulphur, and Phosphorus in the Human Organism. BY H. C. SHERMAN. *U. S. Dept. Agr., Office of Expt. Stas. Bull. No. 121*, 47 pp.—In the ten experiments reported in this bulletin the digestibility of the nutrients in a bread-and-milk diet was determined and the comparative metabolism of nitrogen, sulphur, and phosphorus was studied. The author was the subject of the experiments. The percentage of proteïn actually digested was 95.4. It was not appreciably influenced by loss of sleep but was increased 0.7 on a restricted diet as compared with a liberal diet of the same composition. Marked loss of sleep increased the elimination of nitrogen, sulphur, and phosphorus, the increase of sulphur being proportional to that of nitrogen while the phosphorus was slightly higher. The results are published as a progress report and are not considered as warranting broad generalizations. One object of the work was to secure data regarding methods of work and possible sources of error. H. W. LAWSON.

Report of the Chemists. BY L. A. VOORHEES AND J. P. STREET. *N. J. Agr. Expt. Sta. Rep.*, 1901, pp. 15–210.—This includes analyses of commercial fertilizers and feeding-stuffs, determinations by a potassium permanganate method of the availability of organic nitrogen in thirty-one classes of fertilizing materials, data concerning losses sustained by barnyard manure when allowed to leach, results of tests with field crops of the relative availability of nitrogen in different forms, and a very complete review of investigations concerning denitrification. Taking the nitrogen recovered by oats and corn as 100 in the case of nitrate of soda the relative availability of nitrogen in the other

forms compared was as follows: Sulphate of ammonia, 87.75; dried blood, 73.07; fresh solid manure, 26.36; leached solid manure, 21.99; fresh solid and liquid manure, 51.46; and leached solid and liquid manure, 35.91. H. W. LAWSON.

Bacteria of the Soil in Their Relation to Agriculture. BY F. D. CHESTER. *Pa. Dept. Agr. Bull. No. 98*, 88 pp.—This is a summary of present knowledge relating to soil bacteriology. The elements and sources of plant food, nature and origin of soils, number, distribution, and significance of bacteria in the soil, chemical changes produced by soil bacteria, and the assimilation of atmospheric nitrogen are topics considered. A bibliography is appended. H. W. LAWSON.

Report of Analyses of Paris Green and Other Insecticides in 1902. BY L. L. VAN SLYKE AND W. H. ANDREWS. *N. Y. (State) Agr. Expt. Sta. Bull. No. 222*, pp. 265–268.—Analyses are given of 44 samples of Paris green collected during 1902 and representing 23 different manufacturers. The total arsenious oxide varied from 55.39 to 61.40 per cent., and averaged 57.10 per cent.; the water-soluble arsenious oxide varied from 0.61 to 1.35 per cent., and averaged 1.01 per cent.; the copper oxide varied from 27.03 to 30.79 per cent., and averaged 29.41 per cent.; and the arsenious oxide in combination with copper varied from 50.63 to 57.60 per cent., and averaged 55.10 per cent. The general results are considered as showing a good quality of Paris green on the market at the time the samples were taken.

H. W. LAWSON.

PATENTS.

AUGUST 26, 1902.

707,833. Same as above but adds resorcin to the reaction mixture. A blackish powder sparingly soluble in cold water.

707,886. Johan G. Wiborg and Wilhelm Palmaer, Stockholm, Sweden. **Manure.** Apatite or other phosphate is placed in an electrolytic cell with a salt solution adapted to liberate an acid at the anode, forming a soluble salt with lime, while at the cathode a basic hydroxide is formed, the acid dissolving the phosphate and precipitating the same in the alkaline liquid of the cathode in a soluble form.

707,889. Alfred Wohl, Charlottenburg, Germany. **Extracting sugar.** Mixes molasses with an alkaline oxide, aqueous solution, adds lead protoxide, allows to stand till a viscous mass has formed and washes with water at 40°, filter pressing and washing the contents with water first at 40°, then gradually raised to 75° C., decomposing the lead sucrate, separating the precipitate and concentrating the liquor, adding calcium hydroxide, carbonating at 60° to 90° C. and filtering.

707,892. Alexander P. Anderson, New York, N. Y. **Treating starch.** The process consisting in heating air-dry starchy material under pressure and suddenly reducing the pressure to a point where the liquid in the starch granules will gasify.

707,898. Feodor Boaz, St. Hyacinthe, Canada. **Artificial stone.** Silicate of magnesia is mixed with a small amount of lime and sufficient water to make it plastic, and molding and steaming the product. Sand may be added.

707,903. Alexander Classen, Aachen, Germany. **Converting wood into sugar.** Moist cellulose 100, aqueous sulphurous acid 35 parts, heated in a closed vessel to 145° C. thirty to sixty minutes, blowing off the acid and lixiviating the product.

707,907. Eugene Depetro, Paris, France. **Retting ramie.** Treats the fiber with natural sea-water, or an artificial imitation thereof.

707,953-4-5. Horace S. Blinn, Omaha, Nebr. **Depilating compounds and use thereof.** Calcium oxide 90, arsenic sulphide and sodium sulphite 10 each, mixed with water to a thick paste. To use, first shave, then apply the paste mixed with turpentine. The last covers sulphur 60, sodium hyposulphite 30, and turpentine 10 parts.

707,971. Paul A. Knapp, Grantville, Ga. **Amalgamating metals.** Assignor to American Amalgamating Co. Strongly agitates mercury and pulp in a closed vessel, removes the gangue, extracts the heavier particles, returns said particles to the mercury mixture and repeats agitation.

707,985. Charles H. Tolhurst and Abel G. Goldthwaite, Troy, N. Y. Assignors to Wm. B. Tolhurst and Son, same place. Making **laundry starch.** Stirs and superheats a mixture of insoluble starch and water till the starch becomes soluble and partly dissolved, then cutting, subdividing and cooling the mass.

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768,003. Otto A. Bailer, Philadelphia, Pa. **Substitute for rubber.** Gum arabic 10, rubber 20 (dissolved in benzene), whiting 25, sulphur 45, all per cents, then adding three parts by weight of feathers to one part of solution, semidrying the whole, molding and vulcanizing.

708,044. Evan B. Hopkins, South Kensington, England. Obtaining **zinc.** Heats carbon to incandescence, roasts zinc sulphide ore, mixes it with carbonaceous material, heats the mixture in a retort and passes the fumes up through the incandescent carbon.

708,079. Fritz Roessler, Frankfort-on-Main. Assignor to Roessler and Hasslacher Chemical Co., New York, N. Y. **Sodium cyanide.** A mixture of sodium cyanide and sodium carbonate is

treated with water less than required for solution, the lye is separated and the residue treated with more water to dissolve all the cyanide and the second solution is used for a fresh batch, whereby, on cooling, sodium cyanide only is deposited and by heating the crystals to 33° C., 40 per cent. of the pure salt is obtained in an anhydrous condition.

708,178. William A. Smith, Cleveland, Ohio. **Varnish oils.** A substitute for linseed oil made of equal parts of low-grade illuminating oil (petroleum) and the product of resin boiled in sulphuric acid.

708,259. William H. Russell and George E. Russell, Jersey City, N. J. **Bunsen burner.** The burner has a telescopic burner tube and a telescopic chimney aligned therewith.

708,309. Jegor Bronn, Cologne, Germany. Assignor to Gesellschaft zur Verwerthung der Patenta für Glaserzeugung, same place. Making **glass by electricity.** Mixes the raw material with water glass or plaster of Paris as binding material, forces it between rolls to compress it in a rod or strip that is subjected to an electric current to melt it.

708,330. George Eichelbaum, Berlin, Germany. **Food extract.** Peptonizes milk, adds dilute mineral acids and heats; when the lactose has become glucose, neutralizes the acids, adds yeast, ferments, filters and concentrates.

708,331. Alexander D. Elbers, Hoboken, N. J. Treating **iron ores.** Mixes fine ores with pulverized slag, burns with stirring to agglutinate the mixture into lumps for blast-furnace use.

708,333. George Erlwein and Albert Frank, Berlin, Germany. Making **cyanides.** Heats calcium cyanide, carbon, and a metallic chloride till melted.

708,353. Charles R. Harris and Christopher C. Barrick, Los Angeles, Cal. Fire-proof **wall plaster.** A dry powder of clay 900, calcined plaster 800, cement 250, asbestos fiber 40, and glue 10 pounds.

708,354. Same as above with sand.

708,363. George W. Ketcham, Newark, N. J. **Enameling metal.** Coats iron with copper or similar non-corrosive metal, then with an enamel of feldspar 500, borax 300, soda-ash 15, fluorspar 25, saltpeter 50, cryolite 50 parts, and color; the enamel, on heating, partially oxidizes the coating metal.

708,396. Wilhelm H. Phillippi, Burgel-Offenbach, Germany. **Tanning hides.** Bates, as usual, then immerses the hides in a mixture of wood tar 100, and turpentine 72, or carbolic acid. Coal-tar may be used.

708,422. Jacob Stephan, Cleveland, Ohio. Assignor one-half to Godfrey Fugmann, same place. Composition for **building blocks.** Pulverized rock and whiting 90 per cent., and 10 per

cent. of a binding liquid of white lead 1.5, zinc white 1.5, vegetable oil 90, and a paint drier 7 parts.

708,429. Ernst Voetter, Uerdingen, Germany. **Printing sulphur dyes.** Mixes a purified sulphur dye with sodium carbonate and sulphur, prints and steams, thereby developing the dye.

708,456–7. Basil W. Boesch, Boston, Mass. **Cellulose acetate.** Treats viscose with acetyl chloride and acetic anhydride to remove the alkali metal and form a haloid salt, and then purifying by treatment with naphtha.

708,504. Henry F. Sulman and Hugh F. Kirkpatrick, London, England. Treating **ore slimes.** Adds some lime to the charge of a centrifuge, removes the bulk of the water and adds leaching solution equal to the remaining water.

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708,511. Fritz Ach, Mannheim, Germany. Assignor to C. F. Boehringer Sohne, Mannheim-Waldhof, Baden, Germany. **Para-methyl-amino-phenyl glyoxylic acid.** Formula $CH_3.NH.C_6H_4.CO.COOH$, easily soluble in boiling water, cold alcohol, acetone, acetic ether, difficultly soluble in cold chloroform, ether, and benzene, softens on heating to 140° C., decomposes with frothing at 155° to 157° C., forming short orange prisms. Methyl-anil-alloxan is dissolved in potash lye, mercuric oxide added and boiled in reflux till ammonia disappears, filter, evaporate to dryness, digest with alcohol and again evaporate, dissolve residue in water and precipitate the new substance with a mineral acid.

708,512. Fritz Ach, as above. **Diacetyl-diamine,** 4-5-diacetyl-diamino uracyl, in which an acid radical and hydrogen are separately bound to the nitrogen atoms in the position 7 and 9 of the uric acid, the CO group of the position 8 having been removed, crystallizing in fine felted needles, giving a strong murexid reaction on boiling with HCl, without adding an oxidizing agent, reducing silver only after long boiling, has no melting-point but sinters and turns brown at 300°C.; on further heating it decomposes. Obtained by heating uric acid proper with acetic acid and pyridine under pressure till the product does not reduce silver except on long boiling, and separating the diacetyl compound by boiling with water.

708,513. Fritz Ach, as above. **Thioxanthine,** 3-methyl-8-xanthine, $C_6H_6N_4SO_2$, decomposing at 340° C., soluble in 400 parts boiling water and crystallizing from same in bright yellow laminae. Obtained by heating a potassium salt of 3-methyl uric acid with CS_2 and water in a closed vessel to 150° C.

708,549. Fritz Heiliger, Andernach, Germany. **Thermophore, a flexible holder for a crystallizable substance** with opposed contact bodies so arranged as to move toward and away from each

other whereby crystallization of the substance is produced or may be started by the friction caused by the rubbing of the contact bodies.

708,561. Adolph Kayser, Buffalo, N. Y. **Separating alumina from silica.** Marl containing alumina 18, silica 28, calcium oxide 54 per cent. is mixed with sodium carbonate in the proportion of 34 soda to 100 marl, burned to a sintering heat, leached and the alumina recovered.

708,580. Harry Pearse and Eyre F. Ievers, Buenos Ayres, Argentina. **Antifriction metal alloy.** Lead 75, antimony 15, tin 6, copper 3, cast iron and wrought iron 5 per cent.

708,584-5. Alexander S. Ramage, Cleveland, Ohio. **Pigment.** A light yellow, hydrated basic oxide of iron, $Fe_2O_3Fe_2(OH)_6$, impregnated with an independent coloring agent. Adds alkali to ferrous liquors from pickling iron, and heats the mixture by steam while stirring. See patent 691,324.

708,591. Nelson J. Ruggles, Columbus, Ohio. **Wall plaster.** Pulverized partly slaked, dried and bolted lime 375, fire-clay 250, and sand 1600 parts.

708,649. John C. Kessler, Milwaukee, Wis. **Insect repellent.** The fat acid of cocoanut oil 4, amyl acetate 4, and alcohol 2 pounds and sassafras oil a half ounce.

708,662. Alcide F. Poirrier, Paris, France. Assignor to Ste. Ame des Société Matières Colorantes et Produits Chimiques St. Denis, Paris, France. **Blue sulphur dye.** A mixture of *p*-phenylenediamine and a phenol are oxidized and the indophenol dissolved in water with sodium sulphide, then the mixture is reacted on with the product of the action of sulphur chloride on phenols. Black, soluble in water blue, precipitated by acids, the precipitate being soluble in soda and the dye giving blue tints of great resistance.

708,694. George H. Christian, Cleveland, Ohio. Assignor one-half to Charles Herbert Taylor, East Cleveland, Ohio. **Secondary battery plates.** Made by reducing an oxide of lead in an electrolytic cell containing an electrolyte of a compound of oxalic acid and an alkaline earth.

708,695. Same as above, except for deoxidizing in same solution.

708,760. Arthur Fielding, Salford, England. **Viscose** (cellulose xanthogenate). Adds a bisulphite to the viscose used in filling paper, dries and steams with paper pulp.

708,761. As above, for fixing **viscose on textile fabrics.**

708,774. Edward L. Livingstone, New York, and Wilmot A. Vandercook, Brooklyn, N. Y. **Composition for disinfecting.** An alkaline permanganate 3, sodium chloride 72, hydrogen peroxide 1, manganese dioxide 1, and water 1232 gallons.

708,788. Heinrich Wachwitz, Herzbruck, Germany. Assignor one-half to Moriz Dunklesbuhler, Nuremburg, Bavaria. **Welding metals.** Rubs the surfaces with metallic aluminum to prevent oxidation previous to welding.

708,823. Johann Minder, Piesteritz, Germany. Assignor to Oxylin Werke, Aktien Gesellschaft, same place. **Treating rubber goods.** Coats textile fabric with a mixture of heavy hydrocarbon, India rubber, loading and coloring substances, dries and vulcanizes, and runs through heavy hydrocarbon heated, and then dries.

708,840. Christan P. Sorenson, Copenhagen, Denmark. **Welding and soldering aluminum.** First heats the metal to 300° C., then treats with concentrated soda-lye, and washes in water.

708,918. Henri Perrin, Serezin du Rhone, France. **Enameled polychrome photographs.** Sensitized emulsion is applied to a suitable translucent base, the exposure with negative is made, a vitrifiable powder of neutral tint is brushed over the surface, vitrifiable powders of different colors are successively applied, the darkest first, the undecomposed part of the emulsion is removed and the article baked.

708,921. Isaiah L. Roberts, New York, N. Y. **Calcium carbide.** Mixes molten lime and finely granulated anthracite coal.

708,935. Edward H. Strange, London, and Edward Graham, Tilehurst, England. Assignors one-half to Edmund R. Burrell, Milwall, London, England. **Making varnishes.** Heats hard gum in an excess of turpentine in a closed vessel till dissolved, distils off a part of the turpentine to carry off water, etc., filters off solid impurities, and distils off excess of turpentine, adds non-volatile drying oil below the temperature of discoloration of the oil, or evaporation of the turpentine.

708,941. Frank J. Tone, Niagara Falls, N. Y. Making **iron,** by adding pure elemental silicon to molten iron or steel.

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709,003. Henry V. Dunham, New York, N. Y. **Soluble milk albumen.** Evaporates whey to a heavy sirup at temperatures below the coagulating point of albumen, separates the milk-sugar crystallized out, adds a little acid to precipitate the albumen, which is removed by straining, washes and dries.

709,004. Thomas Edwards, Sebastopol, Ballarat, Victoria, Australia. **Chlorine generator.** A semicylinder with flat top, journals near the top on which it may rock, a dome surmounting the top, a gas-pipe leading therefrom, and a covered opening in the flat top on one side of the dome.

709,037. Walter Pethybridge, London, England. Treating **telluride ores.** Ore containing gold telluride with iron is pulverized; dilute HCl is added that forms ferric chloride by which the gold telluride is decomposed.

709,038. **As above** but uses a solution of ferric sulphate; the filtrate is removed and the tellurium separated by metallic iron; it is then boiled for ferrous sulphate, that is, oxidized by potassium chlorate and nitric acid to ferric sulphate and the gold recovered from the residue.

709,086. Friedrich Elias, Berlin Germany. **Magnesium peroxide.** An acidulated solution of magnesium chloride is acted on by barium peroxide.

709,151. Richard Herz, Frankfort-on-Main, Germany. Assignor to Leopold Cassella and Co., same place. **Blue sulphur dye.** Paraaminotolylparaoxyphenylamine is heated with polysulphides. A dark blue powder scarcely soluble in water but soluble in caustic alkalies red-purple, in concentrated sulphuric acid dark blue, dyeing from alkaline sulphide baths fast blue shades.

709,159. Joseph Koetschet, St. Fons, near Lyons, France. Assignor to Société Chimique, anciennement Gilliard Monnet et Cartier, Lyons, France. **Ortho sulphonated toluylic aldehyde.** Metatoluylic aldehyde is acted on by sulphuric acid of 60 per cent. anhydride at low temperature. Formula $C_8H_8SO_4$, crystalline, soluble in water, forms neutral salts with alkalies or alkaline earths, and when the sodium salt is acted on by phosphorus pentachloride, a chlorine derivative is obtained insoluble in water.

709,160. As above, but for **green dye** by condensing the above aldehyde with an aromatic amine, and oxidizing the leuco product. May use a substituted aromatic amine, the formula will then be $C_7H_6(SO_3H)COH(X)_2$ in which X is the amine. The dye is soluble in water and dyes wool and silk bright blue to blue-green.

709,186. Arthur Weinberg and Felix Klingemann, Frankfort-on-Main, Germany. Assignors to Leopold Cassella Co., same place. **Blue dye.** Diazotized aminoacetnaphthalide sulpho acid is combined successively with 2 molecules of Cleve's acid, diazotized again, and finally add 2-amino-5-naphthol-7-sulphonic acid. Soluble in water bright blue precipitated by HCl, soluble in concentrated sulphuric acid dark blue precipitated by water.

709,187. Arthur Weinberg, Frankfort-on-Main, Germany. Assignor to Leopold Cassella Co., same place. **Yellow acridine dye.** Acridine yellow, formaldehyde and an aromatic amine are condensed by heating. The dye dissolves in water and alcohol yellow, the latter showing a green fluorescence; in diluted mineral acids it is orange.

709,188. George W. Wodicka, St. Louis, Mo. **Wall finish.** Four parts gum tragacanth is soaked in water twenty-four hours, then boiled an hour and mixed with 2000 parts marble dust, dried and pulverized, then mixed with alum 20, and glue 80 parts.

709,218. Harry L. Haas, New York, N. Y. Assignor to

Zucker Leavitt and Loeb Co., same place. **Melting nickel.** A continuous process of melting and refining nickel substantially similar to an iron blast-furnace.

709,268. Daniel P. James, Eureka, Ill. **Alloy.** Copper 72, tin 9, nickel 4, aluminum 1, and silver 2 parts.

709,277. Camillo Perron, Rome, Italy. **Copper nickel ores.** Acts on ore with a solution of an alkaline sulphide, agitates and separates the liquid, washes the residue with cold water and reduces the metallic nickel with hydrogen sulphide.

709,291. Cushing Adams, Bellows Falls, Vermont. **Thickening cotton oleaginous compound.** Adds 7 parts of caseïn in alkaline solution to 60 cotton-seed oil, whereby a solidified compound is made. (Lard substitute.)

709,321. Ludwig O. Helmers, Hamburg, Germany. **Separating sulphonic acids.** Reacts with sulphuric acid on sulphuretted hydrocarbons and separates the products which are soluble in water from those which are insoluble.

709,352. Edgar Nelson, Lima, Ohio. Treating **animal tendons.** First saturates them with a preservative as niter, alum, etc., then coats them with powdered talc, plumbago, or mica for machine packings.

709,358. Emil Pollacsek, Buda Pest, Austria-Hungary. **Desulphurizing furnace gases.** The gases are passed through a sponge-like material made by the action of the gases themselves on a mixture of sawdust 10, non-coking fuel 30, coking fuel 20, peat 30, and caustic lime 20 parts.

709,372. James Tatham, Philadelphia, Pa. **Combustion process.** Causes combustion gases by a current of preheated air to be drawn down through incandescent fuel from a mass of non-incandescent but heated fuel, passing these gases in like sequence through another part of said fuel and finally over the first part where the down draft is maintained.

709,379. Alexander Vosmaer, Watergraafsmeer, and Adriaan Lebret, Utrecht, Netherlands. Assignors to Ozon Maatschappy Systeme. A. Vosmaer, Amsterdam, Netherlands. **Apparatus for treating liquids with gases,** etc. A cylinder has a diaphragm in the middle so finely perforated, liquid cannot pass through but gas can under pressure, and suitable inlet and outlet pipes for liquids and gases, the latter with baffle plates before their mouths.

709,431-2. Willard D. Baker, Rogers, Arkansas. Assignor to E. B. Harrington, trustee, Kansas City, Mo. **Preserving food.** Subjects food products in a closed chamber to the action of an iron sulphur mixture in water which oxidizes potassium carbonate and charcoal.

The second is for a similar process in which paper impregnated

with KNO_3 is burned in the chamber in the presence of potassium carbonate, CO_2, creosote and free oxygen.

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709,482. Adolf Gutensohn, London, England. Assignor to Sulphur Elimination Syndicate, London, England. **Removing sulphur from sulphides.** Crushed ore is mixed with carbon and sodium sulphide, heating to incipient redness and exposing freely to air.

709,488. Wm. S. Huntington, New York, N. Y. Assignor to Composite Board Co., same place. **Artificial lumber.** Molds, presses, and dries wood pulp in slabs or sheets that are exposed to vapors of sulphuric acid, caseïn, litharge, and an alkali.

709,489. George F. Jaubert, Paris, France. **Alloys of alkali metals.** Mixes the metals in required proportions, heats *in vacuo* to 200° C. to 300° C. and cools.

709,490. Jaubert as above. **Compressing sodium peroxide.** Powders the peroxide and another salt as potassium bisulphate, mixes the two and presses into cakes.

709,498. Alfred Molay, Buenos Ayres, Argentina. **Apparatus for mixing gases.** A casing having air and gas inlets and outlets, a series of adjacent peripheral chambers in a revolving drum, each chamber having a contracted tubular outer and inner portion overlapping the respective adjacent chamber.

709,530. Daniel Wieser, Zurich, Switzerland. **Enameled plates.** Coats with a mixture of zinc white and oil varnish, dries, coats with greasy lacquer color, dries, grinds dull with pumice powder in water, prints with permanent colors, dries and coats with greasy copal varnish, and dries.

709,527. Edward Thiesen, Baden, Germany. **Treating gases.** A gas and a liquid are caused to mix by giving longitudinal motion to the gas while exposing it to centrifugal action, and simultaneously applying a force contrary to the main longitudinal motion of the gas, placing a liquid film in the path of centrifugal action of the gas whereby the liquid is caused to travel spirally in a direction opposite that of the main flow of the gas.

709,544. Arthur S. Hoyt, Brooklyn, N. Y. **Adhesive.** The solid matter from gluten water of wheat starch manufacture, concentrated, cooked and dried.

709,563. Otto Thiel, Kaiserslautern, Germany. Producing **iron.** A regenerative furnace is heated by hot reducing gas, part of the flux is added, the gas shut off, the ore, carbon and remainder of the flux introduced, the gas readmitted and cut off to equalize temperature, then readmitted till reduction takes place, and molten iron is then added to take up reduced iron.

709,570. Sylvester Zuckschwerdt, Leopoldshall, Germany. Making **cyanate of potassium.** Adds water to the salt mixture

of the synthetic cyanide process at 60° C., just enough to dissolve out carbonate, then adds more water at 5° C. to dissolve cyanides, the cyanate remaining undissolved.

709,583. William Schoening, Christiana, Norway. **Preserving eggs.** Fresh eggs are warmed in water for a few seconds, then cooled in a solution of cold salt water 80, salammoniac and sodium silicate each 10 parts.

709,651. John T. Slough, Woodstock, Canada. **Cement.** Caustic soda 1, magnesium oxide 2, caseïn 16, water 36 parts.

709,664. Antoine Charon, Montreal, Canada. **Peat for fuel.** Dries, disintegrates while carbonizing by a current of electricity, mixes with petroleum enough to press in briquettes.

709,713. Valentine Lapp, Lindenau, Germany. **Non-alcoholic beer.** Heats wort in a current of pure air, saturates with ozone, adds CO_2 under 10 atmospheres pressure, cools and filters the wort, saturates with CO_2, filters again and stores under 10 atmospheres of CO_2.

709,745. Arthur W. Chase, Avoca, Iowa. Treating **ores of sulphur and iron.** Pulverizes and mixes with finely divided carbon, roasts at full red heat in free air, stirring and mixing with common salt equal to the copper present, then roasts at dull red in free air and leaches with water and steam under pressure to dissolve soluble salts and treating the residue by known processes.

709,751. David W. Davis, Detroit, Mich. **Preserving food.** Freezes animal food below freezing-point, immerses in water below 32° F. to form an inclosing shell of ice, and stores at a temperature below freezing.

709,772. Herbert A. Humphrey, Westminster, London, England. **Purifying gas.** A series of centrifugal apparatus is used, each delivering into the next succeeding, and a cyclone into which the last delivers.

709,783. James H. Lester, Roanoke, Va. **Insecticide.** Gunpowder 10, sulphur 16, saltpeter 8, copperas 4 parts.

709,808. Frank J. Tone, Niagara Falls, N. Y. Assignor to Carborundum Co., same place. **Carborundum articles.** Compresses a mixture of amorphous carbide and the crude materials from which the carbide is made, then crystallizing it by intense heat.

709,817. Clinton E. Dolbear, Boston, Mass. Assignor to American Mining and Metal Extraction Co., same place. **Treating ores electrolytically.** Dissolving crushed ore in a compound of a nitric acid radical, adds sulphuric acid and passes a current of electricity through the mixture.

709,846. James A. Young, Nyack, N. Y. Assignor to Conrad Doersch, same place, trustee. **Ammonia generator.** An am-

monia generator of a compressed rotary inclosing soluble member of an ammonium salt and a loose inner soluble member of caustic alkali, to soften water for laundry use.

709,851. Charles B. Harris, New York, N. Y. Assignor to S. I. Atwater, trustee, same place. **Artificial fuel.** Petroleum coke 10, Texas asphalt 7, glue 3, water 20, and coal dust 160 parts.

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709,867. Charles S. Bradley and Dimmitt R. Lovejoy, New York, N. Y. Assignors to Atmospheric Products Co., Niagara Falls, N. Y. **Nitrogen compounds from atmospheric nitrogen.** Cools air exposed to the action of the electric arc sufficiently to condense the resulting nitrogen tetroxide, which is separated and collected, then further cooling the remaining gases to condense the nitrogen trioxide and separating and collecting it also.

709,868. To same parties for apparatus to carry out the above process.

709,922. Harry S. Mork, Boston, Arthur D. Little, Brookline, and Wm. H. Walker, Newton, Mass. Assignors to Chemical Products Co., same place. **Cellulose esters.** Treats cellulose with acetic anhydride, naphtholsulphonic acid, and a salt of naphtholsulphonic acid.

709,954-5. John W. Bailey, Jersey City, N. J. Assignor to Union Lead and Oil Co., same place. Apparatus and process of making **white lead.** Comminutes metallic lead and forms it in masses not compact, moistens it with acetic acid and water in a corroding chamber, then exposes it to CO_2, causing it to fall through said chamber to rearrange the mass and present new surfaces, and repeating this operation till the lead is corroded.

707,956-7. Same as above except that circulation of gas is provided for.

709,971. Edwin Edser and Meyer Wildemann, London, England. **Electrolysis of alkaline salts.** The speed of solution of the alkali from the amalgam is increased by plates of conductive material attached to carbon and put in contact with the amalgam.

710,005. Ralph H. Page, Detroit, Mich. **Organic peroxide.** A mixture of an aromatic aldehyde and an anhydride of a fatty acid are oxidized by the restricted action of a gaseous oxidizing agent as air.

710,019. York Schwarz, Hanover, Germany. **Photographic emulsion.** Silver phosphate, silver chlorate, and an organic silver salt as a citrate with an emulsifying agent as gelatin. No free silver nitrate is in the finished film.

710,047. Arthur Eichengrun, Elberfeld, Germany. Assignor to Farbenfabriken of Elberfeld Co., New York, N. Y. **Pyrotechnic compound.** Magnesium powder and manganese peroxide equal parts.

710,059. Paul Julius, Ludwigshafen, Germany. Assignor to Badische Anilin und Soda Fabrik, same place. **Brown violet azo dye.** Diazotized chlor-2-naphthylamine-5-sulpho acid reacts on β-naphthol after treatment with sodium carbonate on heating to 50° C. to make a dye that on reduction with stannous chloride and hydrochloric acid yields 1-2-aminonaphthol and an aminonaphthol sulpho acid, dissolving in hot water with a claret color, in concentrated sulphuric acid violet and whose sodium salt gives a blue solution in water that becomes violet on adding caustic soda.

710,125. Charles B. Trescott, Portland, Oregon. **Curing food.** Simultaneously drying and scrubbing combustion gases, refrigerating the same, reheating them and applying them to the food.

710,190. Frederick W. Gaertner, Saginaw, Mich. **Extracting albumen.** Vegetable matter in powdered form is heated to a temperature below that at which the albumen, which is rendered insoluble by alcohol, coagulates; the albumen is then extracted and dried in a centrifugal machine.

710,221. George Stroh, Detroit, Mich. **Ammonia still.** A specific construction of a coffee still, the gas passages with caps being staggered throughout all the pans of the still.

710,233. Johann Adelsberger and Hugo Friedmann, Vienna, Austria-Hungary. Assignors to Simon Wechsler, same place. **Lithographic printing color.** Varnish 300, glycerin 400, an alkaline salt 15, tartar 150, a resinous oil 300, and a pigment as required.

710,287. Ernest Lottier, West Hoboken, N. J. **Plastic composition.** A boot heel of silk fiber and dissolved shellac, molded round a wood core.

710,300. John A. Potter and Wm. C. Harvey, Monterey, Mexico. **Treating matte.** Blows air on the surface of liquid matte, and rabbles the molten mass to expose it to air.

710,346. Constantin J. Tossizza, Paris, France. **Electrolysis of copper ores.** The ores are roasted and leached; sulphurous acid is introduced into the solution with a current of such voltage as to decompose the copper salts but not the other salts present.

WM. H. SEAMAN.

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WILLIAM A. NOYES, Editor.

REVIEWERS:

M. T. Bogert, E. M. Chamot, B. S. Cushman, Benton Dales, L. M. Dennis, A. H. Gill, H. M. Goodwin, W. F. Hillebrand, L. P. Kinnicutt, H. W. Lawson, G. N. Lewis, H. N. McCoy, A. A. Noyes, J. W. Richards, S. P. Sadtler, J. O. Schlotterbeck, W. H. Seaman, F. P. Underhill.

INORGANIC CHEMISTRY.

The Problem of the Systematization of Inorganic Compounds. BY JAMES LOCKE. *Ztschr. anorg. Chem.*, **33**, 58–80.—The authors' theories and results which have recently been published in several papers in the *American Chemical Journal* (*this Rev.*, **7**, 148; **8**, 263, 266, 341, 445) are here brought together in more concise form and used as arguments against the electro-affinity theory of Abegg and Bodländer (*this Rev.*, **8**, 446).

H. N. McCOY.

The Production of Calcium and Strontium. BY H. DANNEEL. *Electrical World and Engineer*, **40**, 1002.—This is an account of the work of Borchers and Stockem (*Ztschr. Electrochemie*, **8**, 757) on the production of calcium and strontium electrolytically. The electrolytic cell is made of a cylinder of carbon, which serves as the anode. It has a bottom of insulating material. The bottom is hollow and is cooled by flowing water. An iron rod, which passes through the bottom of the cell forms the cathode. To make metallic calcium, a layer of powdered fluor spar is first placed in the cell and on top of this, calcium chloride. The fusion of the latter salt is started by means of small, electrically heated rods of carbon which are temporarily so placed in the cell as to make electrical connection between the anode and cathode. The fluor spar remains solid. The metallic deposit on the cathode contains much calcium chloride, which may be removed, to a large extent, by squeezing while still hot. This product contains 90 per cent. of calcium. It may be fused to a silvery mass. Metallic calcium can be produced for 90 cents per kilo. Strontium can be made similarly.

H. N. McCOY.

On Borate of Manganese. BY H. ENDEMANN AND JOHN W. PAISLEY. *Am. Chem. J.*, **29**, 68–73.—Commercial borate of

manganese, intended for use as a dryer for oils, is usually a very impure article. Manganese borate, formed by precipitating the chloride with borax, loses boric acid when washed. The remaining residue rapidly oxidizes in the air. To prevent oxidation an excess of borax is sometimes used and the product is not washed. Other manufacturers decolorize the washed and oxidized product by the addition of sodium sulphite or some other substance. The authors analyzed the washed precipitate obtained from manganese sulphate and borax and found 20 to 25 per cent. less B_2O_3 than the formula MnB_4O_7 demands. The compound $MnB_4O_7.5H_2O$ was obtained as a rose-colored amorphous mass by adding boric acid to the washed precipitate and allowing the mixture to evaporate spontaneously. The salt loses $2H_2O$ at 120°.

H. N. McCoy.

MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

1. Babingtonite from Somerville, Mass. 2. Babingtonite from Athol, Mass. By C. Palache and F. R. Fraprie. *Proc. Am. Acad. Arts Sci.*, 38, 383–393. Two plates.—Although long ago recorded from Somerville, this is the first description of the mineral from that locality. The doubt hitherto obtaining as to the identity of the Athol mineral with babingtonite is now removed by more exact crystallographic measurements than were before possible. The Somerville mineral has by Fraprie's analysis the following composition, showing less manganese and much more aluminum than the average: SiO_2, 52.55; TiO_2, 0.18; Al_2O_3, 5.27; Fe_2O_3, 7.49; FeO, 11.05; MnO, 1.94; CaO, 20.36; MgO, 0.46; $(K,Na)_2O$, 0.22; Loss (H_2O), 0.29; Total, 99.51. The ratio is $RO_2 : R_2O_3 : RO$ as 8.86 : 1 : 5.67, and the formula deduced is $(Ca,Fe,Mn)SiO_3.(Fe,Al)_2(SiO_3)_3$, with the two molecules present in about the proportion $5^3/_4$ to 1. At Somerville the babingtonite occurs in veins and pockets in a dyke of diabase. The common associates are: Prehnite, quartz, epidote, pyrite, chlorite, feldspar, and calcite, with laumontite, stilbite, chabazite, melanolite, and chalcodite also reported. At Athol the mineral is found implanted on dark green epidote coating a fragment of chloritic gneiss. W. F. Hillebrand.

The Genetic Classification of Ore-Bodies.—A Proposal and a Discussion. *Eng. and Min. J.*, 75, 256–258. February 14, 1903.—This is a most interesting résumé of a portion of the proceedings at a recent meeting of the Geological Society of America (January 14, 1903). Mr. W. H. Weed presented a tentative genetic classification of ore-bodies, in which great importance was attached to the direct effect of magmas, not only in supplying heat, water, and gases, but the metalliferous contents of the deposits as well. The great majority of ore-bodies owe their existence either directly or indirectly to igneous intrusions. This

paper brought out a keen discussion and a second genetic classification was presented by Mr. J. E. Spurr, in which also a large rôle was ascribed to igneous magmas. In the space at disposal it is impossible to do any sort of justice to the discussion or to indicate the features of the systems proposed. The medium of publication is accessible to most readers, however, and those interested are strongly urged to consult it.

W. F. HILLEBRAND.

Report of the State Bureau of Mines, Colorado, for the Years 1901-1902. BY HARRY A. LEE. 310 pages; map.—The chapters of this report supply information as to the geology, topography, vein formation, ore deposition, location, and commercial importance of the various counties. The analyses are almost entirely of mineral waters, mostly old, but some apparently of recent date and perhaps not accessible in standard publications.

W. F. HILLEBRAND.

On the Chemical Composition of Axinite. BY W. E. FORD. *Am. J. Sci.*, **15**, 195–201.—New analyses of carefully selected material have removed the doubt hitherto existing as to the true formula for this mineral. It was found that only by repeated fusions with sodium carbonate, and with addition of quartz-powder before the first fusion, could all the boron be extracted so as to be recoverable by the Rosenbladt-Gooch method. In the reviewer's opinion this perhaps explains the unsatisfactory results obtained in former years with other complex silicates containing boron. The analyses, somewhat condensed, are :

	1. Bourg D'Oisans. Average of three.	2. Obira, Japan.	Ratios. 1.	Ratios. 2.
SiO_2	42.78	41.80	8.00	8.00
B_2O_3	6.12	5.61	0.97	0.92
Al_2O_3	17.67	17.15	1.99	1.99
Fe_2O_3	0.99	1.11		
FeO	6.02	2.84	6.99	7.00
MnO	2.99	10.71		
CaO	20.16	19.51		
MgO	2.41	0.21		
H_2O	1.40	1.22		
	100.54	100.16		
Spec. grav.	3.287	3.028		

The ratio of silica to boric oxide is in each analysis simple and constant, hence probably the latter does not replace silica. Only by regarding the water as the equivalent of monoxide bases are interpretable ratios obtainable, and then they are very sharp. They lead to the orthosilicate formula $R''_7R'''_4B(SiO_4)_4$, in which R'' is chiefly Ca, with varying amounts of Mn, Fe, Mg, and H_2, while R''' is mainly Al with a little Fe. Rammelsberg's analysis of axinite from Bourg D'Oisans fits this formula, and so do those of Genth on material from Franklin, N. J., after substitution of

correct water values for the old faulty ones. Whitfield's analyses are probably defective by reason of failure to extract all the boron. In a note at the close of the article are described the two types of crystals from the new Japanese locality, Obira, in the Province of Bungo. W. F. HILLEBRAND.

Note on the Amphibole Hudsonite Previously Called a Pyroxene. BY S. WEIDMAN. *Am. J. Sci.*, 15, 227–232.—The mineral hudsonite, classed for sixty years with the pyroxenes, is now shown to be an amphibole by reason of its optical properties and cleavage angles. An analysis by J. L. Nelson and W. W. Daniells is as follows: SiO_2, 36.86; TiO_2, 1.04; Al_2O_3, 12.10; Fe_2O_3, 7.41; FeO, 23.35; MnO, 0.77; CaO, 10.59; MgO, 1.90; Na_2O, 3.20; K_2O, 1.20; H_2O at 110°, 0.70; H_2O at red heat, 0.60; total, 99.72. From this it appears that the mineral corresponds rather with barkevikite, hastingsite, and similar alkali amphiboles than with the common ones.

W. F. HILLEBRAND.

Recent Geologic Work in Franklin and St. Lawrence Counties. BY H. P. CUSHING. *20th Rep. State Geologist*, pp. r23–r82. Plates and map. (From *54th Ann. Rep. New York State Mus.*).—From a study of the age and relationships of the augite syenite, mainly in the vicinity of Tupper Lake, the following conclusions are reached: "1. That the Adirondack anorthosite is cut intrusively by an augite syenite which is therefore younger. 2. That, while the larger part of the augite syenite of the Adirondacks is in such situation with respect to the anorthosite as to render impossible any determinations of relative age, its general character is so uniform throughout that it is exceedingly probable that it is all of the same approximate age and consists of intrusives from the same source. 3. That at their borders these syenites pass over into granites, part of which, at least, cut the syenite eruptively and are therefore younger. 4. That the syenite grades into granite on the one hand and into gabbro diorite on the other, and apparently into anorthosite as well. 5. That the three together, anorthosite, syenite, and granite, form a great eruptive complex in the heart of the Adirondack region, and that all are younger than the (in part at least) sedimentary Grenville rocks." A considerable number of analyses illustrate the descriptions of the rocks, several of which, by E. W. Morley, appear in print for the first time. W. F. HILLEBRAND.

Precambrian Outlier at Little Falls, Herkimer County. BY H. P. CUSHING. *20th Rep. State Geologist*, pp. r83–r102 (from *54th Ann. Rep. New York State Mus.*).—The crystalline exposures at this place, long regarded as gneiss, anorthosite, etc., and only recently recognized as syenite, are here for the first time adequately described and shown to be an acid quartz syenite affiliated with the monzonite group. W. F. HILLEBRAND.

The Quarry Industry in Southeastern New York. By Edwin C. Eckel. *20th Rep. State Geologist*, pp. 1141–1176. Plates and map. (From *54th Ann. Rep. New York State Mus.*).—This report contains a number of analyses, none of them new, collected from various sources. W. F. Hillebrand.

Recent Developments in the Gypsum Industry in New York State. By Arthur L. Parsons. *20th Rep. State Geologist*, pp. 1177–1183 (from *54th Ann. Rep. New York State Mus.*).
W. F. Hillebrand.

The Mesabi Iron-Bearing District of Minnesota. By Charles Kenneth Leith. *U. S. Geol. Survey Monograph*, 43, 316 pp.; maps and plates.—To the chemist, Chapter IX of this comprehensive report will be of greatest interest, treating, as it does, of the origin of the ores. "The ores are shown to develop mainly from the alteration, under surface conditions, of green ferrous silicate granules, as first pointed out by Spurr. The green granules, however, instead of being glauconite, as maintained by Spurr, are believed, from their lack of potash, to be of different nature, and have been given the name greenalite. Their development is believed to be analogous to that of the iron carbonates of other parts of the Lake Superior Region. That is, the iron was carried to the Upper Huronian ocean in solution, probably as carbonate, was precipitated as ferric hydrate, was buried with the vegetable material and reduced to the protoxide form, and was then combined with silica to form ferrous silicate. In the Gogebic district, where silica was not present in so great abundance, the protoxide combined for the most part with carbon dioxide to form iron carbonate. The shapes of the granules may be due to replacement of minute shells, such as those depositing glauconite or those giving shape to the granules of much of the Clinton ore." It is thus apparent that the theory advanced by Murray and Renard (Challenger Reports, Deep-sea Deposits) for the development of modern glauconite deposits cannot apply without much modification to the deposits in question. It may be added that the lack of potash is not the only ground for regarding the granules as different from glauconite. The secondary concentration of the ore into deposits consisted essentially in the oxidation of the iron and the segregation of the iron and silica. At present "waters flowing through the altered portions of the formations are concentrating ore by the solution and abstraction of silica, but little iron being carried in solution." The report contains many analyses, mainly from the laboratory of the Geological Survey, and there is a table of analyses of known glauconites.
W. F. Hillebrand.

The Chemistry of Ore-Deposition. By Walter P. Jenney. *Trans. Am. Inst. Min. Eng.* (New Haven Meeting, October,

1902), Author's Edition, 54 pp.—The paper makes a strong presentation of evidence showing the powerful influence of carbon and carbon compounds in the formation of metallic and sulphide ore deposits, especially where these are found in limestones or dolomites impregnated with carbonaceous matter, or in sandstones or other formations associated with coal or hydrocarbons. In certain fields (as the lead and zinc regions of Southwestern Missouri) the author's investigations have shown "that the solid oxygenated hydrocarbons, particularly when in fine powder and in suspension in the water circulating through the ore bodies, are the most energetic and powerful reducing agents known." Hence it is fair to conclude that they may have exerted similar effects elsewhere where their presence is manifest in the ore-carrying strata. Even the gaseous hydrocarbons were probably very active under the conditions accompanying and following their formation from bitumens and coals during igneous intrusion. Theoretical equations are given for the reduction of oxidized metallic salts by a variety of natural carbonaceous bodies. There is also a table showing the relative reducing power of several of these and of a large number of native minerals, based on a scale of Hydrogen = 100 as the most effective of all, from which it appears that all forms of carbonaceous matter far exceed in theoretical reducing power any one of the minerals. The relative order of the principal deoxidizing agents is: 1, bitumen; 2, bituminous coal and carbonaceous shale; 3, marcasite and pyrite; 4, blende; 5, galena. Ferrous sulphate stands next to the bottom of the list notwithstanding its known great influence in effecting both reduction and oxidation. "This low quantitative value is in many instances more than offset by the large amount of ferrous sulphate continuously supplied by the progressive oxidation of the pyrite in the ore deposits."

W. F. Hillebrand.

ANALYTICAL CHEMISTRY.

Analysis of Crude Sulphur. By Frank B. Carpenter. *J. Soc. Chem. Ind.*, 21, 832.—In some crude Mexican sulphur only a part of the sulphur was soluble in carbon bisulphide and the ignition method could not be used on account of the presence of calcium sulphate containing water of crystallization. As this water was gradually given off at 100° C. the moisture was determined by drying in a vacuum over sulphuric acid. The substance was then boiled with dilute hydrochloric acid, filtered in a Gooch crucible, dried and weighed. This removed the calcium sulphate; the sulphur in the residue was found to be readily soluble in carbon bisulphide.

B. S. Cushman.

On Screens Transparent Only to Ultra-Violet Light and Their Use in Spectrum Photography. By R. W. Wood. *Phil.*

Mag. and J. Sci. (6), 5, 257–263.—The author has made a screen quite transparent to the ultra-violet rays and yet opaque to visible light. Very dense cobalt glass, coated with a thin film of gelatin stained with nitroso-dimethyl-aniline, is transparent only to the extreme red and to the ultra-violet, and the red is removed by a thin sheet of Chance's "signal-green" glass. This screen freely transmits everything between wave lengths 34 and 38. The employment of glass screens limits the ultra-violet transmission, and a screen of this description is useful chiefly for lecture demonstrations. A combination of a tube furnished with quartz ends, on one of which is a thin film stained with the nitroso compound, transmits all of the ultra-violet, and only the extreme red, but it is very inconvenient to use. A screen, useful perhaps in astrophysical work, is made by combining nitroso-dimethyl-aniline with a small amount of the dye uranine, the latter removing the bluish green portion of the spectrum which affects the photographic plate. These screens make it possible to photograph the ultra-violet lines in grating spectra of higher orders than the first, entirely uncontaminated by the visible radiations which overlie them. Other applications are suggested. The author gives a number of photographs of the spectrum of the cadmium spark taken with varying exposures and with layers of the various solutions and glasses with which he worked before the slit of the spectrograph; also some of the iron and cadmium spark spectra which show very clearly the utility of the nitroso screen in photography with the concave grating. Two photographs of the same landscape, one taken on an orthochromatic plate by yellow light through a screen of dense aurantia, the other taken on an ordinary plate by ultra-violet light, show distinctly the absence of contrast in the latter except between white objects and objects not white. BENTON DALES.

A Sensitive-strip Spectropolariscope. BY D. B. BRACE. *Phil. Mag. and J. Sci.*, (6), 5, 161–170.— The author uses, instead of the ordinary nicols, cylinders of α-monobromnaphthalene with plates of spar placed at the proper angles. This system transmits almost completely and without displacement the ordinary ray and totally reflects the extraordinary one. In cutting the spar, two directions in the crystal are tried. In the first system the longest axis of the plate lies in a principal plane through the optic axis, making an angle of 70° with it. In the other the faces are principal planes through the optic axis, which is perpendicular to the longest edge of the plate. The first plate is about 2 mm. thick, the second or sensitive strip only 0.15 mm.; the angle of each is 70°. He uses a special system of mirrors and prisms for obtaining a uniform illumination of the fields. A series of settings for the C, D, and E lines is given, the single values deviating from the mean by from 0.004° to about 0.005°. BENTON DALES.

Methods for the Investigation of Canceling Inks and Other Stamping Inks. BY E. E. EWELL. *U. S. Dept. Agr., Bureau of Chem. Circ. No. 12.* 8 pp.—Methods devised for the purpose of ascertaining the suitability of canceling inks for the use of the Post-Office Department, where a rapidly drying ink and one that is relatively indelible as compared with the ink used for printing the postage stamps is required. H. W. LAWSON.

Determination of Sulphur in Steel. BY B. F. WESTON. *Iron Age*, January 15, 1903.—The evolution method gives results 0.005 to 0.025 per cent. low, in pig and cast iron. G. T. Dougherty has advocated annealing the drillings for fifteen minutes. The author has applied this annealing also to steel drillings of basic open-hearth steel. Results with 12 samples showed a gain of 0.0005 to 0.004 per cent. sulphur by the evolution method, when the samples had been annealed fifteen minutes over a blast-lamp in a covered porcelain crucible. The average gain was 0.003 per cent. J. W. RICHARDS.

METALLURGICAL CHEMISTRY AND ASSAYING.

The Production of Minerals and Metals in the United States during 1902. BY J. STRUTHERS. *Eng. Min. J.*, January 3, 1902.—With its accustomed enterprise, this journal prints on the third day of this year the approximate statistics of the last year. Of the metallic ores, compounds, and metals produced, the following are the more important, the weights being in metric tons, followed by the total value at the place of production: Bauxite, 26,213 tons, $109,046; carborundum, 1,724 tons, $342,058; iron ore, 35,371,024 tons, $57,443,100; aluminum, 3,311 tons, $2,284,590; antimony in hard lead, 2,283 tons, $351,217; copper, 303,844 tons, $78,630,453; gold, 131.968 tons, $87,710,189; pig-iron, 18,024,423 tons, $310,460,045; lead, 242,690 tons, $21,770,534; mercury, 1,110 tons, $1,488,221; silver, 2,091,567 tons, $35,067,275; zinc, 143,742 tons, $14,380,650. Some other important items were: Barytes, 45,359 tons, $162,500; cement, 3,904,334 tons, $29,195,748; anthracite coal, 40,888,748 tons, $82,931,867; bituminous coal, 225,189,912 tons, $295,389,950; coke, 21,750,399 tons, $61,118,621; copper sulphate, 21,827 tons, $2,045,125; white-lead, 105,587 tons, $12,215,025; red-lead, 12,546 tons, $1,437,054; limestone used as flux, 9,695,763 tons, $5,235,712; litharge, 9,858 tons, $1,057,696; crude petroleum, 10,583,843 tons, $65,761,604; phosphate rock, 1,606,293 tons, $5,338,065; pyrites, 308,606 tons, $1,194,064; salt, 2,889,353 tons, $8,747,761; soda, 528,000 tons, $9,477,600; zinc-white, 43,383 tons, $3,648,740. The total value of non-metallic products was $886,694,362; of metallic products, $569,149,785; grand total, deducting duplications, $1,360,344,147. J. W. RICHARDS.

A New Ore Classifier. *Eng. News*, January 8, 1903.—A description of the Klein ore classifier made by the Allis-Chalmers Co. The action of the water used is obtained by jets of compressed air entering the bottom of the tank, thus agitating the water and sizing the material. The bubbles rise to the surface and carry with them the slimes and fine material, which are thus carried off by a minimum amount of water. The sizing is done by the air, while the water carries away the fines. Air is used at 30 pounds and water at 15 pounds pressure. The classifiers for coarse material require fifty gallons of water per minute and treat 75 tons of ore in twenty-four hours; those for fine material require 20 gallons per minute and treat 50 tons in the same time. The working results on lead, zinc, and gold ores are said to be very satisfactory. J. W. RICHARDS.

Static Electricity Applied to Ore Dressing. BY W. G. SWART. *Eng. Min. J.*, January 24, 1903.—Description of a process patented February, 1901, by Prof. L. I. Blake, of Kansas State University, and L. N. Morscher, giving the working of a machine installed in Denver. The method consists in bringing the ore particles into contact with a statically charged surface, when such as possess high conductivity are repelled and thus separated from those of low conductivity. Most of the sulphides and valuable metallic minerals are in the first class, while the gangue—quartz, calcium carbonate—is in the non-conducting class. Zinc compounds are non-conductors, thus allowing blende to be separated from pyrite, galenite, and chalcopyrite, without preliminary roasting, dryness being the only requisite. Satisfactory work is done with 10,000 to 20,000 volts, giving a spark $^1/_8$ to $^1/_4$ inch long. The static generator used is entirely of metal, and can be run in the open air without regard to atmospheric conditions, moisture, dust, etc., and with as little attention as a dynamo receives. The separators can pass through 12 to 15 tons per twenty-four hours, working on blende at 30 mesh. The standard machine is 24 feet long, 41 inches wide and 81 inches high, and takes 1 horse-power. It separates minerals without reference to their specific gravity, it works well at any mesh from 8 to 200, no roasting of sulphides is necessary, and no water is required. Zinc ore with 49.20 per cent. of zinc was separated into 18.22 per cent. of tailings carrying 3.60 per cent. of zinc, and 80.21 per cent. of heads, carrying 60.69 per cent. of zinc.

J. W. RICHARDS.

The Management of Metalliferous Mines. BY A. WILLIAMS, JR. *Eng. Mag.*, January, 1903.—Placer deposits form a class in themselves; so few men are employed that their management is simple. To run a gold dredger is much like the job of a contractor on harbor improvements. Other surface workings are often as simple as quarrying. Veins of fine gold and refractory

gold ores form another class, the mining of which is done on well-recognized principles. Silver mines present very intricate problems, and require diversified experience and a knowledge of economic geology. Lead mines have usually to be worked with strict economy to make them pay, and the manager must be well versed in concentration methods. Copper mines rival iron mines for large-scale working and close economies; these need large administrative ability, and the manager of the mine often devotes himself mostly to the business end of the enterprise, and relies upon the "mine captain" for the direction of the underground work, and on the mill and smelter superintendents for the metallurgical part. At iron mines mechanical engineering has full scope. Quicksilver mining requires much local experience. The tendency is to separate mining and reduction, thus relieving the mine superintendent of the supervision of the metallurgical work.

J. W. RICHARDS.

Foundry Management in the New Century. BY R. BUCHANAN. *Eng. Mag.*, January, 1903.—An illustrated article dealing with the most modern forms of cranes, stoves for drying moulds, core ovens and moulding machines. There are also many practical remarks about mouldings, facings, etc.

J. W. RICHARDS.

Malleable Cast Iron. BY H. E. DILLER. *Eng. News*, December 11, 1902 (paper read before Am. Foundrymen's Ass'n.).—"Malleable coke iron" or "malleable Bessemer" should be used for the castings, with silicon 0.75 to 1.50, phosphorus under 0.2, sulphur below 0.04, if possible. Steel and malleable scrap may be added, and increase the strength of the castings. The metal may be melted in a cupola, reverberatory or open-hearth, the latter is best. The castings are annealed in iron oxide or mill cinder, 36 to 48 hours, at 1,600° to 1,800° F., and the oven allowed to cool very slowly. The annealing converts combined carbon into temper or annealing carbon, leaving only 0.06 to 0.12 per cent. combined. Over-annealing will reduce the strength, sometimes as much as 7,000 pounds. Good malleable castings show 35,000 to 45,000 pounds tensile strength (60,000 has been reached), with 3 to 5 or even 6 per cent elongation.

J. W. RICHARDS.

The Advances in Moulding Machinery. BY H. TABOR. *Iron Age*, January 1, 1903.—An illustrated article which will interest metal casters in all branches of that art. J. W. RICHARDS.

The Brier Hill Blast Furnace Gas Washer. *Iron Age*, January 22, 1903.—Increase of Mesabi ores in blast-furnace charges causes increased trouble from fine ore in the gases. The washer consists of several pipes dipping a fraction of an inch under water, in a box, the gas thus impinging upon the water and hav-

ing its dust caught. It removes all particles from the gas except impalpable powder, and lowers the temperature of the gas only 25°. J. W. RICHARDS.

Crushed Steel and Steel Emery. BY M. M. KANN. *Iron Age*, January 29, 1903.—This product has been made by the Pittsburg Crushed Steel Company, since 1889. Pieces of high carbon crucible steel are heated to 2,500° F., almost a white heat, and then quenched in a bath of cold water or other suitable hardening solution, which gives it a granular structure. The pieces are crushed under powerful hammers or in crushing machines, being reduced to small particles, which are then tempered by being put into a cylinder or pan, heated to 450° F., and cooled by blasts of cold air. It is then sized, and the grains show sharp-cutting edges. It is used for sawing and polishing stone, and by lithographers and plate-glass makers. A good bond which would permit their being made into a wheel or brick, is being sought for. J. W. RICHARDS.

The West Point Foundry. *Iron Age*, January 1, 1903.—Description of the modern improvements recently installed in this, the oldest foundry in the United States. Well illustrated.
J. W. RICHARDS.

The Duquesne Works of the Carnegie Steel Company. *Iron Age*, January 18, 1903.—This long, well-illustrated article describes in detail the open-hearth plant and the blooming and 14-inch Morgan continuous mills. As an example of the best steel practice, it is valuable and interesting. J. W. RICHARDS.

Development of Gas Engines of Large Units. BY F. B. WHEELER. *Iron Age*, January 1, 1903.—An illustrated article dealing with a subject of particular importance to the producers of gas—blast-furnace managers—and the users of cheap power—electrochemical industries. J. W. RICHARDS.

Gas Fuels for Modern Engines. BY G. E. WALSH. *Iron Age*, January 29, 1903.—Discusses the use of natural gas, producer gas, illuminating gas, and blast-furnace gas in gas-engines for power purposes. Regarding the blast-furnace, engines up to 1,000 horse-power are already in operation, and gas as poor as 27 calories per cubic foot (945 calories per cubic meter) is being used. There is thus possible a surplus power of 3,000 horse-power for every 100 tons of pig-iron produced daily.
J. W. RICHARDS.

The Production of Gold and Silver in the World during 1902. BY J. STRUTHERS. *Eng. Min. J.*, January 3, 1903.—The total production of gold is valued at $306,723,462, of which quantity the United States produced $87,710,189, or 29 per cent.;

Australia, \$81,315,100, or 27 per cent.; Transvaal, \$35,211,345, or 11.5 per cent.; Russia, \$29,971,500, or nearly 10 per cent.; Canada, \$19,500,000, or over 6 per cent.; Mexico, \$9,067,979, or 3 per cent.; and the rest scattering in quantities of 1 per cent. or less. Of silver, the total was 184,213,892 troy ounces, valued at \$100,795,653, of which the United States produced \$35,067,275, or 35 per cent.; Mexico, \$29,693,975, or 29.5 per cent.; the other 35 per cent. is widely scattered. J. W. RICHARDS.

A Review of the Cyanide Process in the United States during 1902. BY C. H. FULTON. *Eng. Min. J.*, January 3, 1903. —A long article reviewing the patents and giving many details of practice at different mills. The treating of Cripple Creek ores by cyaniding has largely given way to chlorination. The use of zinc dust for precipitation is increasing; the dust is admitted to this country free of duty. The cyanide used contains 10 to 50 per cent. of sodium cyanide, but is imported as potassium cyanide at a duty of 12½ per cent. Wet crushing of ores using cyanide solutions has been introduced in many mills, especially in the Homestake mine, South Dakota, with good results. The cost of cyaniding at the Liberty Bell Gold Mine, working 150 tons daily, is 44.1 cents per ton. The cost of cyaniding tailings at the Homestake mine is 35 cents per ton. Precipitation in barrels or precipitation boxes is largely replacing the compartment zinc box. The South Dakota cyanide plants have a daily capacity of 40,000 tons, all using wet crushing with cyanide solution.

J. W. RICHARDS.

The Use of Crude Oil in Smelting. BY A. VON DER RAPP. *Eng. Min. J.*, January 10, 1903 (paper read before the Cal. Miners' Ass'n.). At the Selby smelter, 47 furnaces use oil as fuel, among which are lead, copper and matting furnaces, zinc retorts, cupel and silver smelting furnaces, and an antimony furnace. The extreme length of flames used is 6 feet, the shortest 8 inches. In the large matting furnace, 35 feet by 16 feet clear space, a flame 6 feet or more is needed; in the small zinc retort furnaces one 8 inches long is sufficient. The best burner is of two concentric pipes, the inner one carrying the oil, which is thus steam-jacketed. In buying oil, crude petroleum of 20° B. is best, as the "fuel oil" is often a mixture of light and heavy oils, the latter forming lumps and clogging the pipes. It should not contain over 2 per cent of water and dirt.

J. W. RICHARDS.

Silver Mining and Smelting in Mongolia. BY YANG TSING FOO. *Eng. Min. J.*, January 24, 1903 (Read before Am. Inst. Mining Eng.).—The ores are galena mixed with ironstone. The deepest workings are 400 feet down; the water is carried out in buckets. Dynamite is used for blasting; drill and hammer for

picking out the ore, which is carried to the surface in baskets by boys. The miners do not receive regular wages, but get part of the proceeds. If the ore carries 150 to 200 ounces per ton, each miner may get $20 to $30 per month ; if the ore is poor, running 80 ounces per ton, it pays only for the men's board and expenses of mining and smelting. The waste ore is concentrated in a peculiar spoon-shaped pan, operated in water. The dressed ore is roasted in a primitive furnace which is simply a round wall of blue bricks piled loosely like checker-work, five feet high by six feet in diameter, in which are placed alternate layers of ore and charcoal, and the roasting lasts one week. The cold, roasted ore is put into a dome-shaped smelting furnace built of sun-dried bricks, 3 feet high and one foot internal diameter, open at the top. The bellows is a square wooden box 4 by 3 feet by 16 inches long, with a valve at each end, operated by two men. Ore and charcoal are charged, and the furnace run until about 100 pounds of silver lead has accumulated in the bottom, when the fire is extinguished by water and the cake of lead extracted through a hole made in the bottom of the furnace walls. This cake is cleaned and put into a crude dome-shaped cupel furnace 4 by $3^1/_2$ feet by $2^1/_2$ feet high, resembling a Mexican adobe oven. The cupel is 18 by 12 by 8 inches, made of sifted wood-ashes. It is covered by a mud-brick arch. It takes ten hours to cupel 100 pounds of lead. The silver is 995 fine, and is cast into sycee-shoes weighing 5 to 50 ounces each. J. W. RICHARDS.

Pure Cyanide in Silver-Plating. *Metal Industry*, January, 1903. Certain silver plates use only the purest potassium cyanide, claiming that an admixture of sodium cyanide is very injurious for plating purposes. Commercial cyanide gives uneven deposits, causes local action, and silver is only thoroughly deposited on the work in the immediate vicinity of the anode. A similar fact is true in gold-plating, the sodium cyanide causing a difficultly soluble sodium aurous cyanide to deposit on the anode. The average commercial potassium cyanide contains about 20 per cent. sodium cyanide ; some is almost entirely the sodium salt, while one specimen examined contained two-thirds sodium chloride. J. W. RICHARDS.

An "All Fire" Method of Assaying for Gold and Silver in Blister Copper. BY W. G. PERKINS. *Trans. Am. Inst. Min. Eng.*, 32. The metallic copper is converted into matte by mixing with sulphur in a crucible, covering with flux and litharge, and heating. A charge for a 20-gram crucible is 0.083 assay ton copper borings, placed in the bottom and mixed with 800 mg. of pulverized sulphur ; shake down ; then add on top 0.5 A. T. of Plattner's flux, 8 A. T. of pure litharge, 0.5 A. T. of silica, and cover with salt. Raise the temperature gradually thirty minutes, and leave in the muffle 15 minutes longer. The atmosphere in

the muffle must be reducing. The button obtained weighs about 18 grams. Three such duplicate buttons are concentrated in one scorifier to a 5-gram button, and this finally cupelled fine. Two such gold-silver buttons are united to part for gold, representing the gold in 0.5 A. T. of copper. Time, 5 hours.

J. W. RICHARDS.

The Elimination of Arsenic, Antimony and Bismuth from Copper. BY A. GIBB. *Trans. Am. Inst. Mining Eng.*, 32.—These elements are partly eliminated from the ores during treatment, and partly remain in the product. *Roasting:* A cuprous iron pyrites roasted in heaps lost 75.1 per cent. of its arsenic, 25.4 per cent. of its antimony and 27.8 per cent. of its bismuth. A chalcopyrite ore calcined in a reverberatory furnace lost 61.2 per cent. of its arsenic, 18.8 per cent. of its antimony and 11.3 per cent. of its bismuth. *Smelting:* Two calcined ores smelted in a reverberatory furnace lost 62.8 and 77.1 per cent. of their arsenic, 57.6 and 67.4 per cent. of their antimony, and 20.2 and 27.8 per cent. of their bismuth, respectively. Smelted in the blast furnace, the first calcined ore lost 26.8 per cent. of its arsenic, 27.1 per cent. of its antimony and 51.0 per cent. of its bismuth. The comparative loss in the latter case being less than one-half as much arsenic and antimony and two and one-half times as much bismuth. The elimination of bismuth in the latter case is entirely by volatilization. *Calcining first matte:* The elimination was 35.4 per cent. of the arsenic present, no antimony, and 17.6 per cent. of the bismuth. *Smelting roasted first matte.* The elimination in a reverberatory smelting was 55.5 per cent. of the arsenic present, 59 per cent. of the antimony and 35.7 per cent. of the bismuth. In a blast-furnace smelting 20.4 per cent. of the arsenic present, 22.9 per cent. of the antimony and 43.2 per cent. bismuth. *Roasting white metal:* In this operation, producing blister copper, the elimination was 34.8 per cent. of the arsenic present, 56.4 per cent. of the antimony and 86.7 per cent. of the bismuth. *Refining blister copper:* This last operation removed 29 per cent. of the arsenic present, 41 per cent. of the antimony and 22.5 per cent. of the bismuth. In the preceding cases the removal includes that lost by volatilization and in slags, the remainder being what is contained in the single product which goes forward in the process. *Bessemerizing:* A matte containing 56 per cent. of copper lost 61.4 per cent. of its arsenic, 70.1 per cent. of its antimony and 90.2 per cent. of its bismuth. *Wet precipitation:* By weathering, solution and precipitation, of cupreous iron pyrites, there was eliminated 71.8 per cent. of the arsenic in the ore, 91.4 per cent. of the antimony and 87.9 per cent. of the bismuth. By roasting, washing and precipitation, 91.0 per cent. of the arsenic, 98.6 per cent. of the antimony and 84.2 per cent. of the bismuth. J. W. RICHARDS.

Copper as a Factor in Industrial Progress. BY J. DOUGLAS. *Iron Age*, January 1, 1903.—The average copper ore mined does not contain over 3 per cent. of copper; therefore, to produce the 272,000 tons of copper we make yearly, some 9,000,000 tons of ore must be mined, or about one-third the weight of iron ore mined. Every ton of copper produced requires approximately 4 tons of fuel, to produce it, and about 20 feet, board measure, of lumber is buried underground for every ton of ore extracted. These considerations, as well as the fact of the intricate metallurgy of copper, and the high wages paid to the workmen, all make the copper industry of much greater importance than its mere tonnage of copper produced would indicate. Copper and iron go nearly parallel in their increased output, showing the equal importance of both to our present industrial progress.

J. W. RICHARDS.

Casting Copper in Sand. *Metal Industry*. January, 1903.—If the copper has overheated, it often explodes as it sets, and no good castings are produced. If it is cast without being overheated, liquid copper oozes from the gate for some time during setting, while the casting is full of blow-holes, caused by carbonic oxide. Phosphorus can absorb the oxygen present in the metal as cuprous oxide, but not that as carbonic oxide. Silicon can do both. One pound of silicon-copper containing 10 per cent. of silicon is added to 100 pounds of copper, introducing 0.1 per cent. of silicon. This amount suffices, if the copper is kept well-covered with charcoal and not overheated. A plumbago stirrer is used for mixing the bath, and time is given for the silica formed to rise to the surface. The metal is then skimmed and poured. The silicon may be doubled, if high electrical conductivity of the castings is not a prime desideratum. The precautions to take are summarized as: 1. Use a clean crucible and keep it for this work. 2. Use graphite stirrers and skimmers; iron is rapidly attacked by silicon. 3. Keep metal well covered with charcoal. 4. Do not overheat. 5. Stir and give time for silica to rise. 6. Cast pattern with finished side down, avoiding blow-holes in it, which rise to the upper surface. 7. Do not pour too cold. 8. Silicon will not make up for carelessness in handling the metal. J. W. RICHARDS.

The Telluride of Copper. BY W. E. FORD. *Eng. Min. J.*, January 17, 1903.—A new mineral, named Rickardite, discovered by T. A. Rickard at Vulcan, Col., in the Good Hope mine. The vein is chiefly pyrite containing native tellurium in masses sometimes three inches across; some native sulphur is also found. Rickardite occurs in small lens-shaped masses, usually closely associated with tellurium (see this Review 25, 111).

J. W. RICHARDS.

The Effect of Tellurium on Brass. BY E. S. SPERRY. *Trans. Am. Inst. Mining Eng.*, 32.—In comparatively large amounts, tellurium imparts cold-shortness to high-brass. In the amounts usually found in refined copper, it is not detrimental to brass. Copper unites with tellurium with incandescence, great heat being evolved, but without loss of tellurium. An alloy containing 10 per cent. of tellurium was thus made. In making the brass the copper was first melted, then the tellurium alloy added, and lastly the zinc. The brass made was in each case 40 per cent. zinc, with tellurium replacing copper up to 1 per cent. If there is over 0.06 per cent. of tellurium in the brass, it manifests a tendency to crack in rolling; a few thousandths of 1 per cent. affect the hot-working qualities of pure copper much more powerfully. J. W. RICHARDS.

Spilly Brass: Its Cause and Remedy. BY E. S. SPERRY. *Metal Industry*, January, 1903.—Brass makers recognize three kinds of bad metal: 1. Metal which cracks in breaking down—a difficulty produced by Sb, Bi, or As in the copper, too much lead in the alloy or too high a pouring temperature. 2. "Spuey" metal, containing pin-holes or blow-holes, due to imprisoned gas. After rolling, these defects produce streaks on the sheet, and tear the metal in drawing or spinning. 3. "Spilly" metal; by this is meant imperfections of various kinds produced by charcoal, dross, oxide, or other foreign matter in the plate or bar before rolling. These must be chipped out before rolling; if the work is carelessly done, a streak will be produced on the finished article; if properly done, it will be entirely harmless. But these imperfections should be avoided in the first place by very careful skimming of the metal before and during pouring. In addition to this, oil should be put into the mould, and its proper use is one of the most essential requisites of the caster's art. Mineral oil is unsuited for this purpose, lard oil is used extensively, and is satisfactory if not adulterated; sperm oil is too expensive, a fish oil answers, but produces a disagreeable smell. This surrounding of the stream of metal by burning oil is essential to producing perfect metal. A wooden block placed on the surface of the metal, preferably a block of white pine covering the bath and floating on it, fills the crucible with reducing gas and acts as a skimmer, entirely preventing spilly metal. The metal in falling into the mould should not strike the sides, as that produces porous spots. J. W. RICHARDS.

The Sudbury Nickel Mines. BY A. MCCHARLES. *Eng. Min. J.*, January 3, 1903.—The Canadian Copper Company was absorbed by the International Nickel Company early in 1902, but besides it, there are six mines owned by the Mond Nickel Company, and an equal number by the Lake Superior Power Co., while there are quite a number of other properties held in private

hands. The newly discovered "North Range" contains a dozen or more workable ore bodies. The Orford concentrator at Copper Cliff turns into high-grade matte all the product of the International Nickel Company's smelters. The final product contains 80 per cent. of combined nickel and copper, with more nickel than copper except in that from the Copper Cliff mine. There is $.50 to $1.00 worth of gold and platinum in the ore, per ton. The Mond Nickel Company bessemerizes their matte before shipping it to their refinery in England. The year 1902 was a transition period for these mines; the output was less than in 1901, but the prospects are bright for renewed activity in 1903.

J. W. RICHARDS.

Tin Deposits of the York Region, Alaska. BY E. RICHARD. *Eng. Min. J.*, January 3, 1903.—This region has an area of 120 square miles, with Cape Prince of Wales as the apex and extending some 20 miles each side, along Behring Sea and the Arctic Ocean. The only tin discovered is in creeks and gulches having their source in a range of mountains 1,000 to 1,300 feet high, on the Arctic slope. The range and bedrock of the streams are of slate, probably underlain by quartzite. The tin-stone occurs on the slate bedrock of the streams, but its source is countless small veins scattered through the slate of the range. The richest claim is on Tillery Creek, where the wash is only 16 inches deep, and carries 8 pounds of 60 per cent. cassiterite to the cubic yard, while the cost of extraction is over double the value of the tin-stone. The deposits are, therefore, not rich enough to pay for working in that expensive and inaccessible region.

J. W. RICHARDS.

Notes on Tin Mining in Bolivia. BY J. B. MINCHIN. *Eng. Min. J.*, January 3, 1903.—The deposits are along the mountain ranges on the eastern edge of the great table-land, extending 300 miles in length by 20 miles wide. The lodes dip at 50° to 70°, and traverse highly metamorphic shales, occasionally passing into the adjacent igneous rocks. They are at 13,000 to 15,000 feet elevation. The veins vary up to two meters in width, the vein matter being largely silica, alumina and iron oxide. The concentration mills are 1,000 to 2,000 feet lower than the mines, and connected with them by gravity wire-rope tramways, one to two miles long. There is no coal, except what is brought from England or the United States at $30 per ton. The average ores contain 10 to 12 per cent. tin. It is ground, and passed through hydraulic separators, the fines going to round buddles and Wilfley tables, while the coarse goes to trommels and is concentrated in automatic jigs. The concentrates are exported; they run 67 to 70 per cent. tin. Many of the silver ores, as in the Oruro mines, carry 2 to 4 per cent. tin, which is extracted by cheap concentration of the lixiviation tailings. Some of the mines are worked

as deep as 300 to 400 meters. The total production is about 1,000 tons monthly, of black tin, equivalent to about 800 tons of pure tin, or 9,600 tons yearly. J. W. RICHARDS.

Quicksilver in 1902. BY J. STRUTHERS. *Eng. Min. J.*, January 3, 1903.—The principal producers are the United States, 1,110 tons, an increase of 7.5 per cent. over 1901; Spain, 1,500 tons, an increase of nearly 100 per cent.; Austria, 500 tons; Italy, 250 tons. The Cermak-Spirek furnace, especially adapted for treating low-grade ores with about 0.5 per cent. of mercury, have been quite successfully used in Italy. J. W. RICHARDS.

The Manufacture of White Arsenic in Canada. BY P. KIRKEGAARD. *Eng. Min. J.*, January 31, 1903.—The ores of the Delora Mine of the Canadian Goldfields, Limited, in Ontario, contain auriferous mispickel; they commenced manufacturing white arsenic in 1899. The mine has been known for thirty years, but ordinary amalgamation, roasting and amalgamation, and chlorination were successively unsuccessful in treating the ore. The bromo-cyanide process has been successful. The ore is now crushed in stamps, using inside amalgamation, by which 57 to 60 per cent. of the gold is recovered. The pulp is concentrated, leaving less than 2 per cent. of the gold in the tailings. The concentrates are leached by bromo-cyanide, which extracts 87 to 92 per cent. of their gold content. The exhausted concentrates contain 99 per cent. of the mispickel of the ore. They contain approximately 30 per cent. arsenic and 16 per cent. of sulphur. They are roasted in revolving calciners at a high heat, for two and a half hours, the roasted material being carried away by falling into a stream of water. The fumes driven off pass through a long series of zigzag, hermetically-sealed chambers, where they are mechanically cooled, and deposit a crude arsenic containing 85 per cent. As_2O_3, 2 to 4 per cent. sulphur and the balance silica. The crude arsenic is re-sublimed in a pair of single-hearth reverberatory furnaces, the charge in each being 1600 pounds, and three charges being run per twenty-four hours. The gases pass through a long hot flue, thence into an uptake or hot chamber, and finally, after having been thus separated from dust, into cooling chambers. The white arsenic thus obtained is 99.6 per cent. pure. It is ground to pass a 200-mesh screen, and packed in kegs holding 500 pounds each. The total output has increased to 1,600,000 pounds in 1902. J. W. RICHARDS.

Improved Method of Antimony Smelting. *Eng. Min. J.*, January 31, 1903.—T. C. Anderson patents (U. S. P., 714,040, November 18, 1902) reducing stibnite by melting a bath of iron sulphide on the hearth of a reverberatory furnace, then stirring in the ore, and after the sulphide is well incorporated by rabbling, introducing scrap-iron and shutting up the furnace. When quite

hot, the charge is again rabbled to hasten the reduction. The antimony is allowed to settle, and then tapped out until iron sulphide appears. Then the slag is skimmed off, and the extra iron sulphide removed, to reduce the bath to its original level.

J. W. RICHARDS.

ORGANIC CHEMISTRY.

On Triphenylmethyl. Condensation to Hexaphenylethane by Means of Hydrochloric Acid (Seventh Paper). BY M. GOMBERG. *Ber. d. chem. Ges.*, 36, 376-388.—I. *Are the chlorethers condensing agents?* Apparently their condensing action is due to small amounts of free hydrochloric acid, present either as an impurity or produced by the gradual decomposition of the chlorethers, since when all hydrochloric acid is very carefully removed no condensation occurs. II. *Condensation with hydrochloric acid.* Triphenylmethyl may be very easily polymerized to hexaphenylethane by the action of hydrochloric acid, the rapidity of the condensation depending upon the concentration of the acid, and the reaction proceeding most smoothly in benzene solution. The acetic ester compound of triphenylmethyl was used in the experiments. III. *The action of metals upon triphenylchlormethane in glacial acetic acid.* The author has already shown that by the action of silver or tin upon a glacial acetic solution of triphenylchlormethane, triphenylmethyl is formed in the cold, while if heat be employed the product is hexaphenylethane. This polymerization, which was formerly ascribed to the action of hot acetic acid, is now shown to be due to hydrochloric acid separated from part of the triphenylmethylchloride by the action of hot glacial acetic acid (with simultaneous formation of triphenylmethyl acetate), a reaction which does not occur to any great extent in the cold. This also explains why the yield of hexaphenylethane is greater when tin is used, since more hydrochloric acid is probably liberated from the stannous chloride by the action of the hot acetic acid. Where zinc is the metal used, the reaction is complicated by the strong tendency of the zinc to reduce triphenylmethyl to triphenylmethane, and the yield of hexaphenylethane is correspondingly diminished or may even become zero, if zinc dust be used. In all cases, however, triphenylmethyl is the first product of the action of the metal upon triphenylmethylchloride, and by the action of triphenylmethyl itself with zinc powder, in presence of glacial acetic acid, triphenylmethane was obtained, while an acetic solution of hydrochloric acid polymerized it to hexaphenylethane with formation of some triphenylcarbinol. Triphenylmethane can be easily obtained in any desired amount from the readily accessible triphenylmethylchloride, the yield being about 92 per cent. (description of the method is given). IV. *Reduction of the carbinol.*

The formation of hexaphenylethane from triphenylchlormethane, zinc and 90 per cent. acetic acid, was referred by Ullmann and Borsum to reduction of triphenylcarbinol, which they regarded as the intermediate product, since they obtained the same hexaphenylethane by the action of zinc, stannous chloride and hydrochloric acid upon an acetic acid solution of triphenylcarbinol. Gomberg, however, believes that the carbinol in the latter case is first converted to the chloride by the hydrochloric acid, the zinc changing the chloride to triphenylmethyl, which latter is then polymerized to hexaphenylethane by the hydrochloric acid. Experimental data are given in support of this hypothesis. V. *Do metals separate chlorine or hydrochloric acid from triphenylchlormethane?* If it is assumed that by the action of zinc upon triphenylchlormethane in benzene solution hydrochloric acid is separated, it is conceivable that the slowly formed acid is destroyed by the zinc before it can polymerize the triphenylmethyl; the hydrogen thus liberated might reduce triphenylmethyl to triphenylmethane or possibly hydrogenize the benzene; and, as a matter of fact, 3 to 5 per cent. of triphenylmethane is always formed in the reaction. A dry benzene solution of hydrochloric acid has no appreciable effect, however, upon pure mercury, and if the action of mercury upon a benzene solution of triphenylmethylchloride separates any hydrochloric acid, this could be detected, and some condensation of the triphenylmethyl formed to hexaphenylethane might be expected. On testing this experimentally, although the same triphenylmethyl is obtained as when other metals are used, no hydrochloric acid or hexaphenylethane could be detected in the product, wherefore the author concludes that it is only chlorine and not hydrochloric acid which is separated from triphenylchlormethane by the action of metals, and that the formula originally assigned to triphenylmethyl, $(C_6H_5)_3C$, is entirely in accord with the observed facts. M. T. BOGERT.

On Addition-Compounds of Tetrabrom-o-Benzoquinone (preliminary communication). BY C. LORING JACKSON AND HORACE C. PORTER. *Ber. d. chem. Ges.*, 36, 454-456.—Methyl alcohol and tetrabrom-*o*-benzoquinone, left in contact for eight days at the ordinary temperature, unite to form a *compound*, crystallizing in white rhombic plates, which, when recrystallized from methyl alcohol and benzene, melts at 261°. It is composed of two molecules of the quinone in union with one of methyl alcohol—$2C_6O_2Br_4,CH_3OH$—and is the sole product of the reaction. For bodies of this class it is remarkably stable both to heat and to reagents. When boiled with acetic anhydride and sodium acetate, it yields a true *monacetyl derivative*, crystallizing in monoclinic prisms, and, after recrystallization from methyl alcohol and benzene, melting at 249°. Benzyl alcohol reacts with tetrabrom-*o*-benzoquinone in a similar manner, giving an

addition-compound in which two molecules of the quinone are united to one of the alcohol. Other alcohols seem to show analogous behavior, but the course of the reaction is complicated by simultaneous reduction. When ordinary toluene was left for a week in contact with tetrabrom-*o*-benzoquinone, a yellowish white *body* was formed, apparently composed of two molecules of the quinone and one of water (from the damp toluene used). This is less stable than the methyl alcohol addition-product and begins to decompose at 180°, gradually turning bright red until at 210° it partly melts. M. T. BOGERT.

BIOLOGICAL CHEMISTRY.

The Lecithans and Their Significance for Living Cells. BY WALDEMAR KOCH. *Ztschr. physiol. Chem.*, 37, 181–189.—By the term "lecithan" is meant a wax-like, hygroscopic substance made up of orthophosphoric acid, the higher saturated and unsaturated fatty acids, nitrogenous groups, and glycerin. "Lecithan" is a group name given to such bodies of which lecithin and cephalin may be taken as types. The lecithans are of significance for living cells in that they share in the metabolism of the cell, by means of the unsaturated fatty acids in oxygen metabolism, and by means of the methyl group combined with nitrogen in other unknown reactions.

The following table gives the relation of phosphorus to methyl in different lecithans:

	P. Per cent.	CH_3. Per cent.	Ratio. P : CH_3.
Lecithan from egg	3.9	5.8	1 : 3.1
Lecithan from barley	2.4	3.7	1 : 3.1
Lecithan from malt	2.3	3.2	1 : 2.9
Lecithan from yeast	3.6	2.4	1 : 1.3
Lecithan from brain	3.8	1.7	1 : 1.0

F. P. UNDERHILL.

Products of Prolonged Bacterial Action on Proteins. BY A. E. AUSTIN. *J. Med. Research*, 9 (New Series, 4), 1–15.—Prolonged action of mixed micro-organisms on nucleins and fibrin, and probably other albuminous bodies, produces proto and hetero-albumoses and secondary albumoses, A., B., and C., according to Pick, but no peptone. In both respects their action differs from superheated steam, and the albumoses are not atmid albumoses which cannot be thus separated, but simulate more those produced by trypsin. This bacterial action does not produce hexone bases, and in this respect differs from trypsin. During these investigations there was found a very interesting substance, which presumably was the nitroso-indol described by Salkowski. Further results with this body will be communicated later.

F. P. UNDERHILL.

The Influence of Nephrectomy upon Absorption. By S. J. Meltzer and Wm. Salant. *J. Med. Research*, 9 (New Series, 4), 33–58.—In nephrectomized rabbits, absorption from the peritoneal cavity was found to be more active than under normal conditions. This increase in absorption was most marked in experiments with solutions of sodium chloride of 1.2 per cent., which is decidedly hypertonic for normal animals. In experiments with solutions of 1.5 per cent. or less concentration, not a single case occurred in nephrectomized rabbits in which there was an increase in the fluid injected into the peritoneal cavity, while in normal rabbits such an increase is not infrequent, especially when hypertonic solutions are employed, be they even as slight as 1 per cent. of sodium chloride. The increase of absorption in the nephrectomized rabbits continues to be manifest even when the solutions are introduced into the peritoneal cavity about twenty-four hours after nephrectomy. There is reason, however, to surmise that at a period of about forty hours or more after nephrectomy, the factor favoring absorption begins to diminish. When a solution remains in the abdominal cavity five hours or longer, the ratio of further absorption of this solution seems to become the same for nephrectomized as for normal rabbits. In none of the nephrectomized rabbits was any lymph found on opening the abdomen. F. P. Underhill.

Experimental Fat Necrosis. By H. Gideon Wells. *J. Med. Research*, 9 (New Series 4), 70–117.—Fat necrosis can be produced with constancy in cats and dogs, less successfully in rabbits, by intraperitoneal injections of fresh hog pancreas, and nearly as well with dog pancreas. The results are the same with solutions that are in weak alkalies, sodium carbonate, or in weak acids, acetic acid, or in water. Equally constant results can be obtained with ordinary commercial "pancreatins." Preparations of Carica papaya, although highly irritating, do not produce fat necrosis. This property of pancreatin to produce fat necrosis survives heating for five minutes at a temperature as high as some point between 65° and 71° C.; above this point the property is entirely lost. The amount of fat necrosis produced decreases steadily after exposure at 55° C. and upwards. These observations point to enzyme action as the source of the condition. It has been impossible to ascertain which of the pancreatic enzymes causes fat necrosis. Trypsin, weak in, or devoid of, lipase, will not produce this effect. Lipolytic extracts of hog's or cat's liver are likewise inactive. Extracts of fresh dog pancreas that are, when injected, feeble in, or devoid of, tryptic power, but possess lipolytic power, cause fat necrosis. If to such extracts an emulsion of duodenal mucosa is added, the enterokinase greatly increasing the tryptic activity, no fat necrosis will be produced. As the lipase of pancreatic extract cannot be isolated, it is impos-

sible to ascertain if it by itself is capable of causing fat necrosis ; but it seems highly probable that the lipase causes fat-splitting after some other ingredient of the pancreatic juice has injured the cells. F. P. UNDERHILL.

The Influence of Sodium Chloride upon Gastric Secretion. BY LYMAN BRUMBAUGH STOOKEY. *N. Y. Med. News*, **82**, 303. —Excessive quantities of sodium chloride apparently exert an inhibitory influence on hydrochloric acid secretion and thereby may impede gastric digestion. (This is in harmony with Miller's observations.) The injected sodium chloride is apparently not directly converted into hydrochloric acid in the stomach to the extent, if at all, which one might theoretically expect, assuming the theories of Koeppe and Brasch to be tenable.

F. P. UNDERHILL.

An Experimental Study of the Sugar Content and Extravascular Coagulation of the Blood After Administration of Adrenaline. BY CHARLES H. VOSBURGH AND A. N. RICHARDS. *Am. J. Physiol.*, **9**, 35–52.—The intraperitoneal injection of adrenaline chloride, as well as the application of that substance to the pancreas, gives rise to a marked increase of sugar in the blood. This hyperglycaemia makes its appearance immediately after the administration, reaches its maximum in from one to three hours, and may continue for over fourteen hours. Simultaneously with hyperglycaemia occurs a decided diminution in the time of extravascular coagulation of the blood. This phenomenon appears to be due also to the application of adrenaline to the pancreas. The cause of this form of hyperglycaemia, as indicated by comparative analysis of the blood flowing to and from the liver, is to be attributed, in great part at least, to an increased sugar formation in that organ. F. P. UNDERHILL.

SANITARY CHEMISTRY.

The Salford Sewage Purification Experiments. *Eng. Record*, **47**, 109–111. **A Dozen Years of Sewage Purification Experiments at Salford, England.** *Eng. News*, **49**, 191–192.—These two articles are both reviews of a paper read by Mr. Joseph Corbett, Borough Engineer of Salford, England, at a meeting of the Sanitary Institute, of Great Britain, and reported at length in the Engineer, London, December 28th, 1902. The paper is of decided interest, as it gives an account of a number of experiments, tried on a very large scale, during the past twenty years at Salford, and which have resulted in the process now adopted, *i. e.*, chemical precipitation followed by roughing filters, and continuous intermittent filtration. Salford is a manufacturing city of 250, 000 inhabitants, and its sewage can be characterized as an acid

manufacturing sewage, containing considerable amounts of surface water. The purification works, built over twenty years ago, were for the purification of sewage by chemical treatment, and during the first ten years a great number of precipitation processes were tried, depending on special chemical precipitants. The best and cheapest results were obtained by the use of lime and a salt of iron, either sulphate or chloride of iron, but none of the precipitation processes gave an effluent answering the requirements of the Mersey and Irwell commission, *i. e.*, that one imperial gallon of a sewage effluent shall not contain a greater amount of nitrogenous organic matter than is represented by one grain of albuminoid ammonia, or a greater amount of oxidizable matter than will be oxidized in four hours at a temperature of 20° centigrade by one grain of oxygen, using potassium permanganate as the oxidizing agent. Beside experiments with different chemical precipitants the "International Process," using "ferrozone" as a precipitant, and polarite as a filtering material, was tested at three different times, and the "Webster Electrolytic Process" was carefully investigated. The International Process showed what could be accomplished by the filtration of a tank effluent, but failed to convince the authorities that polarite had the valuable qualities claimed for it, better results being obtained by using the cheapest available materials, such as cinders, crushed clinkers or coke breeze. The Webster Electrolytic Process, passing the sewage between cast-iron plates alternately connected with the positive and negative poles of a dynamo, is, according to Mr. Corbett, the most scientific and most successful of any of the processes studied, and it would have been adopted at Salford but for the inability of the company promoting the process to finance so large a scheme.

Experiments on the filtration of sewage tank effluents have been carried on for the past twelve years. These experiments were undertaken chiefly to determine the best material to use for filters, the depth of filters, and the best method of applying the tank effluent so that it shall trickle down through the filling material. The contact system of treatment was never tried, as, according to Mr. Corbett, it is "illogical," and does not deal with so large a flow as the trickling method. As a result of the experiments which are given in more or less detail, Mr. Corbett believes that cinders are the best material for filters; that a depth of eight feet is, as a rule, the best; and that distribution is best effected by passing the liquid through sprinkling jets in which the liquid is sent whirling, by passing it through inclined holes in the lower part of the jet, before reaching the top outlet, the whirling motion throwing out the water in a very fine spray over a circle about twelve feet in diameter.

The result of all the above research work has been the adoption of the following method of treatment, which was put into

operation at Salford last summer. Milk of lime is first added to the sewage, then a solution of copperas and the sewage is passed through tanks (average time of passage six hours), then through roughing filters of gravel three feet deep, normal rate 4,000 imperial gallons per square yard. From the roughing filters the sewage is distributed by the sprinkling jets on the cinder beds. The average rate proposed is 500 imperial gallons per square yard, or half a million gallons per acre, each bed being used twelve hours per day, though higher rates (one million gallons per acre), on experimental filters working twenty-three hours per day, and run for one year, have given a satisfactory effluent.

As an appendix to the paper, various tables are given, showing the analytical results obtained in certain of the experiments and also a table giving data regarding the Webster Electrolytic Process. LEONARD P. KINNICUTT.

Air Testing in Tunnel Construction. BY JOSEPH W. ELLMS. *Eng. Record*, 47, 246–247 (1903).—In nearly all underground excavations, carbon dioxide, marsh gas, and sometimes hydrogen and sulphide of hydrogen, may be present in greater or less amounts, and carbon monoxide may be formed as the result of the combustion of inflammable gases and the use of certain explosives. In the construction of a tunnel, 4 1/5 miles long, at Cincinnati, a part of the new water works system, several explosions having occurred, it was decided to test the air of the various headings daily to determine the amount of inflammable gases present and the efficiency of the ventilation. The ordinary methods of gas analysis were not considered as well adapted for determining the amount of explosive gases present with the rapidity necessary to make the tests of immediate value, and it was decided to use the "Shaw Gas Tester," a mechanical device, by which different proportions of illuminating gas and air can be mixed in various proportions, and the amount of air that it is necessary to add to the illuminating gas so as to cause an explosion of a definite degree of force, quickly determined. This apparatus, described in detail, and shown in two cuts, is, according to the author, so sensitive that a difference so small as 0.1 to 0.2 per cent. in the amount of explosive gas contained in the air which is added to the illuminating gas, can be detected. The explosive gases thus far encountered in the Cincinnati tunnel, have generally entered the tunnel at points where there was leakage of water into the headings in considerable quantities. They also occur in pockets, and are liberated in the course of blasting, or permeate the rock in places and leak into the excavation because they are under slight pressure. An approximate analysis of the gas bubbling up through the water in one of the headings, gave hydrogen 31 per cent., marsh gas 45.7 per cent., carbon dioxide 2.7 per cent., besides nitrogen and oxygen. Traces of inflammable gases

were not infrequently found, but during the larger portion of the time were absent from the majority of the headings, and when present usually amounted to less than 1 per cent. About 1900 tests for inflammable gases and 1700 for carbon dioxide were made during the past year. The carbon dioxide was determined by absorption in barium hydroxide solution, and titration by oxalic acid. LEONARD P. KINNICUTT.

German Ozone Water Works. *Electrical World and Engineer*, **41**, 119–120. The Ozone Water Works, at Wiesbaden and Paderborn. *Scientific Amer.*, **88**, 132–133.—These two articles give an account of the first use, on a practical scale, of ozonized air for the purification of a water supply. An abstract of an account of the experiments at Martinikfelde, which resulted in the building of the plants at Wiesbaden and at Paderborn, was given last year (*this Rev.*, **24**, 327). The plant now constructed at Wiesbaden is capable of sterilizing 60,000 gallons of water per hour, while the plant at Paderborn, though similar in construction, is designed to sterilize only from 13,000 to 15,000 gallons per day. The plant at Wiesbaden is divided into two independent units, each having its own machinery, ozone apparatus, and sterilizing towers. The engine room contains two 60 H. P. Wolf locomobiles, two direct and two alternating current generators, two centrifugal pumps, to pump the water to the top of the sterilizing towers, and two blowers to force the air to the ozonizers. The direct current generators drive the pumps and fans, while the alternating current generators supply the current for high voltage coils of the six transformers (about 8,000 volts). The ozonizers, of the Siemens type, 48 in all, are divided into two units of 24 each, and each unit into 8. Each of these smaller units is connected with one of the six transformers. The sterilizing towers, constructed of brick and 13 feet high, are arranged in two separate rows of 4 towers each, one of which is always held in reserve. Two cross walls divide each tower into 4 compartments, and each compartment is filled to the height of 6 feet with coarse gravel. The water to be purified passes through this sand and meets the current of ozonized air forced upward through this sand. The quantity of water passing down through the sand in each tower is 11,000 gallons per hour, and the volume of ozonized air passing up through the sand is 31,000 gallons per hour. The cost at Wiesbaden, including the pumping of the water, repairs, and interest is about two cents per thousand gallons of sterilized water. A careful study of the bacteriological effects produced by this ozonizing plant, has been made by Professor Proshaus and Dr. Schuder, of the Institute for Contagious Diseases, at Berlin, and also at the Fresenius Institute, at Wiesbaden. The reports are most favorable, stating that ozonized air of the concentration obtained by means of the Siemens apparatus,

and employed in sterilizing towers with suitable gravel-filling, destroys all pathogenic germs, and almost all of the harmless water bacteria. The ozone concentration obtained at Wiesbaden is not stated in either of the above articles, it is probably about the same as that obtained in the experiments at Martinikfelde, *i. e.*, 2 1/2 to 3 grains per cubic meter.

LEONARD P. KINNICUTT.

Septic Tank at La Grange, Ill. BY WILLIAM B. EWING. *Eng. Record*, 47, 200 (1903).—Description of a closed septic tank, 100 feet long, 30 feet wide, 10 feet deep, divided into three compartments. The sewage of the town is domestic sewage, diluted with storm water; the time of passage through the tank is from twelve to eighteen hours. The tank was put in operation in November, 1901. Very little crust was formed on the liquid during the winter. In the middle of May, 1902, it was 1 foot thick. No odor is perceptible in or near the tank. The paper is of interest on account of the statement that though the action of the tank was successful, at the end of one year's continuous action, when the liquid in one of the compartments was drawn off, there remained a deposit of only 1 inch in thickness.

LEONARD P. KINNICUTT.

The Septic Tank: Its Place in the Treatment of Sewage. BY LEONARD P. KINNICUTT. *Eng. Record*, 47, 16, 1903.—The writer, after giving a brief outline of the development of the septic tank, and stating that it is now generally recognized as an essential part of modern bacterial purification processes, gives the reasons for such recognition, and his opinion, based on experiments made in England and in this country, as well as upon results obtained in actual practice, as to what can be accomplished under different conditions by the use of the septic tank. As to the place of the septic tank in the treatment of sewage, the writer says: "To sum up in one sentence the place of the septic tank in the modern methods of sewage treatment, I should say that in the majority of cases it is a valuable adjunct to the method of intermittent filtration, and an essential adjunct in the methods of treatment by contact beds and percolating filters."

LEONARD P. KINNICUTT.

Alum in Water. A. H. Low's Modification of the Logwood Test. BY ELLEN H. RICHARDS. *Technology Quarterly*, 15, 351–353 (1902).—In Volume 4 (1891, p. 194) of the *Technology Quarterly*, a method for the detection of alum in water was described by Mrs. Richards. This method has been modified by A. H. Low so that one part of alum in 8,000,000 parts of water can be detected. The directions given are as follows: Logwood solution: "Take two grams of logwood chips and boil for one minute in a platinum dish with 50 cc. distilled water. Decant

the solution and boil again for one minute with 50 cc. of water. Decant this and boil a third time with 50 cc. of water. This last 50 cc. of liquid is used for the alum test, and, if kept in platinum, will remain unchanged for at least three days. The test: Boil 50 cc. of the water to be tested in a platinum dish to dispel carbon dioxide, add three drops of the logwood solution and continue boiling for a few seconds to develop the color. Decant into a glass flask, cool quickly under a water tap. Blow into the solution carbon dioxide from the breath, by means of a glass tube, until there is no further decolorization. Transfer to a Nessler tube for comparison with standards similarly prepared. Allow to stand several hours before taking the final reading. Glass dishes cannot be substituted for platinum in the above processes. A blank made with distilled water, if not completely decolorized by the carbon dioxide in the breath, will give a test perceptibly fainter than that produced by one part of aluminum sulphate in 8,000,000 parts of water. Aluminum hydroxide will produce a tint almost as strong as a salt of aluminum in solution. The aluminum hydroxide can be removed from a water by clogging a filter with a little aluminum hydroxide, washing the filter until washings give no test, and then filtering the sample to be tested, through the filter. LEONARD P. KINNICUTT.

Municipal Water Supplies and Their Examination. BY WILLIAM G. BISSELL, M.D. *Philadelphia Medical Journal*, August 30, 1902.—The author, after noting several epidemics of typhoid fever that have occurred through the use of contaminated water, and the problem that confronts all municipalities, large or small, of providing a pure and wholesome water, free from pathogenic bacteria, takes up the question as to the best method of determining if a water supply is contaminated by sewage. He considers the chemical analysis as of comparatively little value, especially if all the local conditions regarding the source of the water are not known, and that in determining the source of pollution the bacteriologist can render far greater service than the chemist, and that by far the most valuable test as indicating the source of contamination is that devised by Stone for detection of the colon bacillus. In the words of the author, "The continued presence of the colon bacillus in quantities of water not exceeding 1 cc. in amount, should be considered as representing a danger signal." The paper concludes with a description of Stone's method of detecting and determining the number of colon bacilli in a water, and the opinions that have been expressed by the leading sanitary experts as to the conclusions to be drawn from finding colon bacilli in a water supply. LEONARD P. KINNICUTT.

AGRICULTURAL CHEMISTRY.

Soils, Waters, Foods, Tanning Materials, etc. By E. W. Hilgard, et. al. *Cal. Agr. Expt. Sta. Rep.*, 1898–1901, Part II, pp. 149–262.—Numerous analyses of soils, alkali, waters, sugar-beets, figs, oranges, hops, canaigre roots, wattle barks, etc., are reported, and a number of subjects, including the formation of hardpan, reclamation of alkali lands, maturing of navel oranges, etc., are discussed. In a laboratory study of the percolation of water through soil by A. V. Stubenrauch, it was found that the rate of percolation was not materially influenced by the diameter of the cylinders used, but that it was retarded by drying the soil at 100° C., repeated wetting and drying and tamping the surface. The use of cylinders 1.5 inches in diameter and 40 inches long is recommended. The rates of flow through black adobe, loam, and sandy soil were compared, the sandy soil showing the slowest rate. A study of some California butters made for export by M. E. Jaffa led to the tentative conclusion that the feeding of sugar-beet pulp in large quantities to cows has a tendency to produce soft butter. The butter-fat from cows fed a daily ration containing 60 pounds of beet-pulp silage showed 6.39 per cent. of butyrin, 37.93 per cent. of olein, 55.68 per cent. of palmitin, stearin, etc., and had a melting-point of 32.7° C. and a refractive index at 25° C. of 1.4598. Analyses of California grown Smyrna figs by G. E. Colby showed the following composition for dried packed samples: Water 21.06, ash 1.72, proteids 4.37, crude fiber 8.02, fat 0.91, and sugar 63.92 per cent. The California grown fruit contained 1.4 per cent. more sugar and 0.3 per cent. more proteids than imported figs. The same author makes a preliminary report on a systematic study of the composition of navel oranges during the process of ripening. The average tannin content of 25 samples of canaigre roots was 30.6 per cent. The tannin in the barks of the black, silver, and golden wattle varied from 33.1 to 54.4 per cent.

H. W. Lawson.

Errors in Manure Sampling and Analysis. By W. Frear. *Proc. Soc. Prom. Agr. Sci.*, 1902, pp. 183–194.—In the examination of two lots of barnyard manure, a comparative study was made of the limits of error in sampling and analysis, from the results of which the author concludes that a large mass of manure can be represented satisfactorily only by original samples of relatively large amount, and that the latter must be thoroughly subdivided under conditions as unfavorable to heating and evaporation as possible. Check weighings should be made at every subdivision and, when the material is sufficiently mixed, triplicate samples should be taken for separate determinations of moisture. Greater accuracy will be secured by the rapid weighing of large quantities on scales of low sensitiveness than by the weighing of

small quantities on more sensitive scales, owing to the rapid drying of the sample under the latter conditions.

H. W. LAWSON.

Studies in Nitrification. BY G. S. FRAPS. *Am. Chem. J.*, **29**, 225–241.—This article was presented at the last convention of the Association of Official Agricultural Chemists and noted briefly in this Journal, R., **24**, 538.

The Source of Nitrogen in Forest Soil. BY R. G. ZON. *Pop. Sci. Mo.*, **62**, 436–440.—This subject is briefly discussed, particular attention being called to the observations of E. Henry, of France, that fallen leaves absorb atmospheric nitrogen during the beginning of the process of decomposition.

H. W. LAWSON.

Preliminary Crop and Soil Data for the Cooperative Study of Available Plant Food. BY C. C. MOORE. *U. S. Dept. Agr., Bureau of Chem. Circ. No. 11.* 9 pp.—In the cooperative investigations in progress by the bureau and twenty or more experiment stations, oats, barley, rye, and wheat have been grown in plat and pot experiments. This circular contains some of the data so far obtained, including descriptions of the soils, the yield and composition of the crops, and determinations of the nitrogen, phosphoric acid, potash, lime, and magnesia removed from the soil by each crop.

H. W. LAWSON.

Third Report on Food Products, 1902. BY B. W. KILGORE, ET AL. *N. C. State Bd. Agr. Bull.*, January, 1903. 77 pp.—Of the 409 samples of human foods examined in 1902 and here reported upon, 87 samples were found adulterated. The percentage of adulteration in 1900 was 56, in 1901, 35.7, and in 1902, 21.3. During the three years 1,404 samples were examined. Analyses are also reported of feeding-stuffs and condimental stock foods.

H. W. LAWSON.

Food Products and Their Adulteration. BY E. F. LADD, ET. AL. *N. Dak. Agr. Expt. Sta. Bull.* No. 53, pp. 115–150.—The use of preservatives and coal-tar dyes in foods is discussed, and the results of analyses of numerous samples of jellies, jams, catsup, canned vegetables, extracts, spices, etc., are reported. Food adulteration was found very extensively practiced in the state.

H. W. LAWSON.

A Study of the Food Value of Some of the Edible Fungi of Ames. BY J. B. WEEMS AND ALICE W. HESS. *Proc. Soc. Prom. Agr. Sci.*, 1902, pp. 165–172.—Analyses are reported of the following species of edible fungi collected in the vicinity of Ames, Iowa : *Coprinus atrementarius*, *C. micaceous*, *Hirneola auricula*, *Hydnum coralloides*, *Morchella esculenta*, *Lycoperdon gigantum*, *L. gemmatum*, *Pleurotes sapidus*, *P. ulmarius*, and

Agaricus campestris. Compiled analyses are also given. While not classed as a food, mushrooms are ranked high as a relish.

H. W. LAWSON.

The Percentage of Water in Canadian Creamery Butter. BY F. T. SHUTT. *Ont. Dept. Agr., Dairy Division Bull. No.* 4, *n. ser.*, 1902. 6 pp.—Determinations of the moisture content of 75 samples of butter received from creameries in different parts of Canada showed a maximum of 16.77, a minimum of 8.92, and an average of 12.16 per cent. The water content of 30 samples obtained at Montreal from packages ready for export was as follows: Maximum 15.37, minimum 7.94, average 12.69 per cent. The average water content of the 105 samples was 12.31 per cent. Only 1 sample contained more than 16 per cent. of water, the limit allowed by the English law. With one or two exceptions the butter was made in July and August and was considered representative of the creamery product as prepared for export to England. The method of determining moisture is given.

H. W. LAWSON.

Poisoning of Cattle by Common Sorghum and Kafir Corn. BY A. T. PETERS, H. B. SLADE AND S. AVERY. *Nebr. Agr. Expt. Sta. Bull.* No. 77. 16 pp.—This contains notes on the symptoms and post-mortem findings in cases of poisoning, chemcal investigations reported upon at greater length in this Journal, **25**, 55, and suggestions as to treatment. The cause of poisoning has been traced to prussic acid which is set free from a glucoside by an enzyme in the plant, and which may be obtained artificially by distillation with water. H. W. LAWSON.

Methods of Corn Breeding. BY C. G. HOPKINS. *Ill. Agr. Expt. Sta. Bull.* No. 82, pp. 525–539.—The breeding of corn for the purpose of increasing or decreasing the content of protein, oil, or starch, has been under investigation at the station for a number of years, with results which have been published from time to time. The methods which have been employed are based upon the physical examination of the ears and kernels and upon chemical analysis and are described briefly in this bulletin.

H. W. LAWSON.

Macaroni Wheat in South Dakota. *S. Dak. Agr. Expt. Sta. Bull.* No. 77. 42 pp.—Results so far obtained in the culture and testing of macaroni wheat in South Dakota are presented. This wheat is reported as yielding from 25 to 100 per cent. more than ordinary wheat and being well adapted to all parts of the state. Brief statements are made by J. H. Shepard concerning the results of chemical investigations. Imported seed in 1900 was found to have a protein content of 14.1 per cent. The crop grown from the seed in 1901 showed 18.8 per cent. The protein

content of the crop of 1902 was 13.9 per cent., the low percentage being attributed to unfavorable weather conditions.

H. W. LAWSON.

Macaroni Wheat. BY T. L. LYON. *Nebr. Agr. Expt. Sta. Bull.* No. 78. 24 pp.—Experiments were conducted to determine the adaptability of different parts of Nebraska to a number of varieties of macaroni wheat. The average yield of all varieties tested in 1902 was 18.3 bushels per acre, which was better than the average yield of other varieties of spring wheat. Macaroni wheat is believed to be a useful crop for the western portion of the state. H. W. LAWSON.

Sugar Beets. BY F. W. TRAPHAGEN. *Mont. Agr. Expt. Sta. Bull.* No. 41. 8 pp.—Analytical and cultural data are given for the sugar-beets grown in 1902 in cooperative experiments with farmers throughout the state. No general conclusions are drawn. H. W. LAWSON.

Progress of the Beet Sugar Industry in the United States. BY C. F. SAYLOR. *Sci. Amer. Suppl.*, **55**, 22,692–22,694.—This is reprinted from the Yearbook of the U. S. Department of Agriculture. See this Journal, R., **24**, 512, 514.

H. W. LAWSON.

PATENTS.

OCTOBER 7, 1902.

710,413. Jules A. Besson, Caen, France. Process of **defecating sugar.** Adds ammonia to the juice, filters it and then adds a finely divided metal as porphyrized aluminum.

710,452. Mary J. R. Greenman, Wilkes-Barre, Pa. **Hardening metals.** Bath is made of sugar, salt, magnesia, borax, potash, arsenic, sulphur and sal ammoniac, 3 ounces each, spirits of niter and sulphuric acid 6 ounces each, and water 5 gallons.

710,493. Ludwig T. Moeser and Wilhelm E. Eidmann, Giessen, Germany. Assignors to Chemische Fabrik Griesheim Electron, Frankfort-on-Main, Germany. **Production of metals of the alkalies.** Heats a mixture of calcium carbide and alkaline fluoride to a red heat in the absence of oxygen.

710,496. Sidney T. Muffley, Bowdre, Ga. Assignor one-half to Runyon Pyatt, New York, N. Y. **Treating ores.** Saturates gold or silver ores with potassium cyanide, agitates and breaks up the mixture in a revolving drum, injects a current of heated air with a spray of fresh solvent at one end of the cylinder and carries off the liberated elements at the opposite end.

710,521. Alfred G. Saunders, Adelaide, South Australia. Making a **mineral absorbent.** Ground carbonaceous clay is lixivi-

ated to settle impurities, caustic soda is added and the mixture boiled while stirring, then washed with weak sulphuric acid, cooled and washed again, and dried.

710,568. Arthur Eichengrun, Elberfeld, Germany. Assignor to Farbenfabriken of Elberfeld Co., New York, N. Y. **Photographic fixing bath.** Acetone alkali bisulphite 4, alkali thiosulphate 100, and water 400 parts.

710,580. Charles J. Holmes, San Francisco, Cal. **Artificial fuel.** Saturates dry coal with a liquid hydrocarbon at normal temperature, agitates the mixture in a closed vessel while heating, and adding rosin, then molds into briquettes.

710,648. Alfred Wohl, Berlin, Germany. Making **acetyl chloride.** Mixes calcium acetate with sulphuryl chloride, thoroughly mixes and disintegrates and distils off the acetyl chloride.

710,665. John J. Cannon and John M. Arnold, Omaha, Neb. **Louse-killing nest egg.** A nest egg of naphthalene impregnated with oil of cedar and oil of mustard.

710,766. Walter Dollfuss, Hochst-on-Main, Germany. Assignor to Farbwerke vorm. Meister Lucius und Bruning, same place. **Blue sulphur dye.** Heats to 130° C. *p*-oxy-amino-*p*-oxydiphenylamine with sulphur and alkaline sulphides, which forms a blue-black bronzy powder, dyeing with sodium sulphide or hydrosulphite a bright indigo-blue, absolutely fast on treatment with copper salts.

710,800. Fritz Peterhauser, Hochst-on-Main, Germany. Assignor to Farbwerke, vorm. Meister, Lucius und Bruning, same place. Process of **dyeing indigo.** Adds protein substances to the hydrosulphite vat and neutralizes with acid bodies.

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711,031. Edward G. Acheson, Niagara Falls, N. Y. Making **graphite.** Introduces into an electric furnace lump carbon as petroleum coke, and a volatile material adapted to form a carbide as iron oxide, and heating to a high temperature so as to volatilize the iron oxide and graphitize the carbon.

711,038. Edward Cullmann, Buffalo, N. Y. Assignor to Schoelkopf, Hartford, and Hanna Co., same place. **Dark sulphur dye.** Dinitrosalicylic acid, sodium sulphide and sulphur are heated together to make a blue-black substance forming, with concentrated sulphuric acid, an emulsion of a dark violet, and dyeing from alkaline sulphides deep black.

711,059-60. John H. Long, Chicago, Ill. Assignor to Chisholm, Boyd, and White Co., of Illinois. **Briquetting iron-bearing substances.** Mixes one part salt with two of water, adds one part soda to 200 of salt, and mixes 15 parts of this brine to 95 of iron-bearing material as a bond, molds and dries. May add 10 parts cream of lime.

711,101. Oscar Foerster, New York, N. Y. Assignor to Universal Chrome Photo Engraving Co., same place. Making **printing surfaces.** Coats stone or metal plate with a sensitized film containing salts that have been crystallized out to form a fine even grain or stipple, printing a negative thereon in the usual way, and repeatedly inking, washing, and etching till all the film is washed away and the picture etched in the stone.

711,123. Lewis T. Rhoades, Phoenixville, Pa. Assignor to Mary V. Gehring, Philadelphia, Pa. **Wave detector.** A wave-responsive device composed of finely divided iron, nickel, carbon, and vaseline. To be placed between a series of separated masses of silver.

711,166-7. William A. Kohneman, Chicago, Ill. Assignor to International Fuel Co., same place. **Fuel briquettes.** Steams bones and obtains thereby a glutinous material that is mixed in proper proportions with carbonaceous material and the whole treated with chlorine and ferrous sulphate solution, molded, and dried.

711,173. Duncan McKechnie, Liverpool, England. **Recovering copper** from copper precipitate. Makes briquettes, dries and smelts in blast-furnace with reducing action, draws the material into a reverberatory furnace to separate the copper from the slag, and refines it.

711,186. George C. Stone, Jersey City, N. J. Assignor to New Jersey Zinc Co., same place. Apparatus for making **sulphuric acid** by the contact process. A series of independently separable and removable sections each having its charge of contact material, and in combination with inlet and outlet ducts.

711,242. Francis Chailly, New York, N. Y. Assignor to Standard Briquette Co., N. J. **Fuel briquettes.** Fuel 90, plaster of Paris 8, and dextrin 2 parts.

711,254. Heinrich Mielck, New York, N. Y. Assignor to Mielck's Stone and Terra Cotta Co., same place. **Artificial stone.** Sand, burnt magnesia, and magnesium chloride in water each 1 part, and kaolin 2 parts.

711,263. Robert C. Robertson, Warwick East, Bermuda. **Remedy for diseases of the skin.** Concentrates sea-water at 80° to 90° F., cools at 40° F. for five days, removes the sodium and potassium chlorides and magnesium sulphate from the precipitate, dissolves the magnesium salt in water and adds to the remaining liquor together with about 5 per cent. of acetic acid.

711,307. Alexander S. Hamilton, Needham, Mass. **Extracting oil** from fish livers. Forms alternate layers of livers and salt, allows to stand at ordinary temperature, removes the oil that rises spontaneously and then presses out the remainder.

711,310. Edouard Hepp, Frankfort-on-Main, Germany. As-

signor to Farbwerke, vorm. Meister Lucius und Bruning, same place. **Polyaminoanthraquinonesulpho acid,** a blue dye, reacts on acyl derivatives of α-amino anthraquinone with nitric acid, 2 molecules, saponifies to eliminate the acyl group, treats the nitroamino anthraquinone with reducing agents, and finally sulphonates. The dye is a dark blue powder, soluble in water, turning red by hydrochloric acid, the free sulpho acid separating as a dark blue precipitate and yielding with concentrated sulphuric acid an almost colorless solution, and dyeing pure blue, even shades, fast to light.

711,329. Heinrich Mielck, New York, N. Y. Assignor to Mielck's Stone and Terra Cotta Co., same place. **Artificial stone.** Mixes sand 4, burnt magnesia, and a concentrated solution of magnesium chloride 1 part each, moulds and keeps in forms till thoroughly set.

711,375. Albert Baudry, Kief, Russia. **Purifying sugar.** Neutralizes with sulphurous acid, filters and electrolyzes, refilters and concentrates, adds alkali and neutralizes again with sulphurous acid at 40° to 50° C., electrolyzes at the negative electrode, whereby the hydrogen combines with the sulphurous acid to hyposulphurous acid which decolorizes the syrup, and finally subjects the syrup to the action of both electrodes.

711,377. Max Bazlin, Ludwigshafen, Germany. Assignor to Badische Anilin und Soda Fabrik, same place. **Solid alkaline hydrosulphite.** A dry solid alkali hydrosulphite that will remain unchanged for twenty-four hours when exposed to dry air at 17° C., and for a month when in a closed vessel, and which slowly crystallizes from water in prismatic crystals that have a refractive action on light.

711,380. Johan C. Berntrop and Marius L. G. Van Ladder Hulsebosch, Amsterdam, Netherlands. **Solid combustible.** Rosin (10) is dissolved in petroleum (60) and decomposed by sulphuric acid (2); slaked lime (10) is mixed therewith and the mass briquetted.

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711,481. Nathan T. Daboll, New London, Conn. **Storage battery plate.** Makes a mattress-like case of wire gauze and fills with finely shredded metal coated with finely divided carbon and covered on the outside with white lead.

711,485. John Edmunds, Waltham, Mass. Apparatus for making **sulphurous acid.** A sulphur furnace and water tank with connecting pipes and means to maintain a uniform level in the tank while causing a continuous supply of water and delivery of acid.

711,525. James F. Place, Glen Ridge, N. J. Apparatus for **liquefying air.** A combination of reciprocating expansion engine with a counter current thermal interchanger and connecting

pipes, the whole enclosed by isolating material, and provided with suitable air purifiers, etc.

711,554. Albert G. Calkins, Los Angeles, Cal. Assignor to F. W. Braun and Co. **Assayers' furnace.** A fire-clay furnace having a muffle chamber and a furnace chamber, the floor of the latter somewhat lower than that of the muffle chamber, the whole supported on legs and enclosed in a sheet-metal jacket.

711,565. Joseph W. Harris, Ashbourne, Pa. **Making ether.** Acetylene gas is united with hydrogen developed by electrolysis; the ethylene produced is acted on by sulphuric acid, and the ethyl sulphuric acid decomposed by alcohol produced by the same reaction. The water content of the electrolytic cell in which these reactions occur must be less than 50 per cent.

711,572. Leopold Kahl, Schwientochlowitz, Germany. As signor to Rudolph Ruetgers, Charlottenburg, Germany. **Oxalic acid ester of *p*-cresol.** Anhydrous oxalic acid is added to a commercial mixture of *m*- and *p*-cresol to form an ester of the *p*-cresol, which crystallizes out and may be separated by filtration or otherwise.

711,577. Casimer Masse, Rantigny, France. Assignor one-half to La Société Francaise de Ramie, Paris, France. Treating **Ramie.** Immerses the stems in a hot alkaline bath, dries and treats with a mixture of alkali and starch which unites with the pectic compounds and forms a pulverulent mass easily detached from the fiber, and then drying and cleaning the same.

711,596. Alois L. Tedesco, Paris, France. Making **varnish.** Gum copal is distilled in a reflux condenser and the terebenthene distillate is freed from water and returned to the gum.

711,603. Moritz Weinrich, Yonkers, N. Y. Purifying **raw sugar.** Mixes with the raw sugar a little fine powdered lime to take up the coating of molasses from the surface of the crystals, then heating and airing the mass, washing out the impurities, and decomposing the sucrate of lime and the organic impurities, and removing them.

711,738. Martin Ruthenberg, Philadelphia, Pa. **Reducing metals from their ores.** Each particle of comminuted ore is coated with reducing material and heated to a temperature below that of reduction, then moving the granular magnetic iron oxide into a reducing temperature, reducing at first without fusing, then moving the mass into a fusing temperature, fusion being produced by an electric current.

711,811. Alfredo Alonzo Consoli, Catania, Italy. **Retort for subliming sulphur.** The combination of a melting-vessel with a sublimation retort on the same plane horizontally, and a communicating tube with the end bent down under the level of the sulphur in the melting-vessel.

711,835. Matihu Ducat, Neuville-sur-Saone, and Charles J. A. Marnas, Lyons, France, and Leopold H. Dehoff, Ludwigshafen, Germany. Assignors to the Badische Anilin und Soda Fabrik, same place. **Silk printing.** Prints caustic alkali and grape-sugar on raw silk whereby it is locally degummed and a pattern made on dyeing the same.

711,875. Michael Miley and Henry M. Miley, Lexington, Va. Assignors to Miley Color Photograph Co., New York, N. Y. **Color photography.** Separate pigment photographs are made on bichromated films of gelatin tissue having inert red, yellow, and blue pigments, respectively, each having a color value substantially that of the primary color it represents, and directly superposing said pigments, a layer of collodion being interposed between the face of the film and the wax on the surface of the temporary support.

711,876. Charles Nettleton, Des Moines, Iowa. **Boiler-cleaning composition.** Glauber salt 86, soda-ash 100, calcium sulphate 10, and slippery elm 4 pounds. One pound of the dry mixture to a boiler of 75 horse-power.

711,904-5. Thaddeus S. C. Lowe, Pasadena, Cal. Apparatus and process for making **coke** and recovering gases. A series of ovens arranged tandem with superheating device on each end and air inlet and exhaust. Air is admitted to the first oven at a gas-making temperature, and the mixed air and gas is passed into the next and so on, air being also admitted at intervals. Steam is also added, and the resultant mixture of gases is finally scrubbed.

711,910. Fritz Roessler, Frankfort-on-Main, Germany. Assignor to the Roessler and Hasslacher Chemical Co., New York, N. Y. Making **sodium cyanide.** Treats a mixture of sodium cyanide and sodium carbonate with water enough to bring all the salts into solution, evaporating the lye till the carbonate crystallizes out and is separated, then cooling out the sodium cyanide and fusing it whereby it is obtained anhydrous.

711,924. Christian F. Gloystein, Henderson, Ky. **Tobacco extract and nicotine.** The raw aqueous extract is evaporated and the vapors condensed from which distillate the nicotine is extracted by passing finely divided drops of carbon disulphide through the distillate and then separating the carbon disulphide containing nicotine, which is washed with acid to obtain the alkaloid.

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711,953. Carl Engau, Frankfort-on-Main, Germany. Assignor to Leopold Cassella and Co. **Imitates logwood** on wool or half wool by dyeing and simultaneously fixing black naphthalene azo color and metallic lakes of tannic acid.

711,990. Emmerich Markovitz, Berlin and Friedrich Guth-

mann, Friedenau, Germany. A compound for **preserving meat.** Gelatin 40, agar agar 15, distilled water 35, and salt 2 parts and the mixture boiled, then 1 per cent. of salicylic acid and 7 per cent. of alcohol are added and again boiled with about 10 per cent. of water.

711,995. Albert D. De Micheroux, Marseilles, France. **Artificial fuel.** Mixes gas tar, 80 per cent., with lime and caustic soda, 20 per cent., heating with stirring and mixing in coal dust or fragments of waste ores, etc.

712,027. William H. Walker, Newtonville, Mass. Assignor to Towle Manufacturing Co., Newburyport, Mass. **Alloy of silver.** A workable alloy of silver and copper, free from fire surfaces, during and after the process of annealing, is obtained by annealing the alloy in an atmosphere of producer gas or other inert gas.

712,045. John J. Crooke, New York, N. Y. **Fertilizer.** Subjects salt marsh material to electrolysis, whereby it is converted into a fertilizer.

712,153. Charles J. Reed, Philadelphia, Pa. **Electrodeposition of metals.** Apparatus comprising a rotatable receptacle, containing a mixture of a liquid electrolyte, an inert or non-conducting granular substance and electrodes contained therein, and a source of electrical energy, with means for producing a circulation of the electrolyte through the granular substance.

712,176. Melchior Boniger, Basle, Switzerland. Assignor to Basle, Chemical Works, formerly Sandoz, same place. **Brown sulphur dye.** Heats β-oxynaphthoquinonalphylimides with alkali polysulphides, forming dark brown powders, soluble in water, unchanged by alkalies but precipitating by acids or barium chloride in brown flakes, insoluble in benzene or toluene.

712,190. Willibald Hentschel, Radebeul, Germany. Assignor to Chemische Fabrik von Heyden Actiengesellschaft, same place. Making **phenyl glycine.** Reacts with 1 molecule of chloracetic acid upon 3 or more molecules of aniline, and separates the product.

712,200. Harry S. Mork, Boston, Arthur D. Little, Brookline, and William H. Walker, Newton, Mass. Assignors to Chemical Products Co., Boston, Mass. **Artificial silk.** Made of cellulose acetate and oleic acid, thymol, etc.

712,225. Herbert H. Wing, New Brighton, N. Y. **Calcium sulphate.** Magnesium sulphate is added to a solution of calcium chloride, giving magnesium chloride and calcium sulphate ; the latter is separated and lime added to the filtrate which makes magnesium hydroxide and calcium chloride.

712,226. Herbert H. Wing, New Brighton, N. Y. Making **alum.** Sulphur dioxide and air are passed into a solution of copper sulphate holding aluminum hydroxide or oxide in suspension, whereby aluminum sulphate is produced; the solution is treated with H_2S, giving sulphuric acid and copper sulphide. The latter is separated and more aluminum oxide added to form a solution of aluminum sulphate only. Potassium sulphate may be added to produce alum.

712,230. Jesse H. Young, Fort Wayne, Indiana. **Cleaning and soldering metals.** Ammonia 1, potassium cyanide 6, distilled water 16, and sal ammoniac $^1/_{24}$ part. Used as a detergent and flux.

712,246. Friedrich von Bolzano, Hochst-on-Main, Germany. Assignor to Farbwerke vorm. Meister, Lucius und Bruning, same place. **Formylmethylanthranilic** acid. Oxidizes halogen methylates of quinoline in aqueous solution.

712,274. Otto Eberhard, Ludwigslust, Germany. **Making milk extracts.** The casein and fat are separated from skim-milk, the latter concentrated by filtering and boiling, separating albumen, evaporating to about 35° Beaumé, adding solution of formaldehyde, evaporating to half volume, precipitating by alkali, adding kieselguhr, slightly acidulating, concentrating to 10° or 12° Beaumé, adding disintegrated meat and pressing out the residue.

712,313. Hieronymus G. Krieger, Chicago, Ill. Assignor to himself, Henry A. Bussian, and Albert Konold, Chicago, Ill. **Reducer for overexposed photographic plates.** Four parts by weight of a saturated solution of copper sulphate and one part of hydrochloric acid.

712,347. Charles S. Wheelwright, Providence, R. I. **Draining crystals of calcium sulphate.** Endless sheets of wire and felt pass over supporting rollers, having at one end a collecting roll so arranged that the draining substance shall lie between the sheet of felt and the collecting roll.

712,389. Henry Knoth, Birmingham, Ala. Manufacturing **steel.** In the open-hearth process reserving from a previous heat a predetermined amount of molten refined metal, and introducing this reserve and the necessary amount of unpurified metal to complete the succeeding charge.

712,406. Francis G. DuPont, Wilmington, Del. **Separating solvents from nitrocellulose.** The material carrying the alcohol-ether is immersed in alcohol and a gas caused to pass through it, carrying off the ether.

712,421. Otto Sohst, Hochst-on-Main, Germany. Assignor to Farbewerke vorm. Meister, Lucius und Bruning, same place. **Yellow to red acridine dye.** Orange-yellow to brown-red powders, soluble in hot water, difficultly soluble in alcohol with yel-

low-green fluorescence, insoluble in ether and benzene, fast to sodium carbonate and ammonia, made from 12 kilos acridine-yellow, heated with 50 kilos of nitrobenzene and seven kilos of benzene chloride, heated to 140° to 150° C. for one-quarter hour, the mass then poured in water, the nitrobenzene expelled by steam, and the dye precipitated by common salt and hydrochloric acid.

WM. H. SEAMAN.

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. IX. No. 6.

WILLIAM A. NOYES, Editor.

GENERAL AND PHYSICAL CHEMISTRY.

The Universally Exact Application of Faraday's Law. BY THEODORE WILLIAM RICHARDS AND WILFRED NEWSOME STULL. *Proc. Am. Acad.*, 38, 409–413; *Ztschr. phys. Chem.*, 42, 621–625. —It is shown that an electric current deposits within 0.005 per cent. of the same amount of silver from a fused mixture of silver, sodium, and potassium nitrates at 250° as it does from an aqueous solution at 20°, thus furnishing the most accurate proof thus far brought forward of the validity of Faraday's Law for a fused electrolyte and at different temperatures. A. A. NOYES.

A Revision of the Atomic Weight of Caesium. BY THEODORE WILLIAM RICHARDS AND EBENEZER HENRY ARCHIBALD. *Proc. Am. Acad.*, 38, 443–470.—Caesium chloride was purified by crystallizing repeatedly the dichloriodide, heating this, dissolving the residue, and precipitating the solution with hydrochloric acid. The ratios CsCl:AgCl and CsCl:Ag were determined from 25 analyses, and the atomic weight 132.877 was calculated therefrom. The corresponding ratios from six analyses of caesium bromide gave 132.880. The ratio $2CsNO_3:Cs_2O$ was also determined by heating the nitrate with pure silica, and from four such analyses the atomic weight 132.879 was calculated. This number is the final value adopted. To test the purity of the reagents and the accuracy of the method, entirely similar analyses were made with potassium chloride and nitrate; the results checked those of Stas almost completely, for they yielded 14.04 and 39.14 for the atomic weights of nitrogen and potassium. No evidence was found of the presence of any element of higher atomic weight, except a little thallium, in the original material used. The specific gravities of caesium chloride, bromide, and nitrate were found to be 3.972, 4.380, and 3.687, respectively, and the melting-point of the nitrate to be 414°. A. A. NOYES.

A New Method of Determining the Vapor Density of Metallic Vapors and an Experimental Application to the Cases of Sodium and Mercury. BY FRANK B. JEWETT. *Phil. Mag.*, (6), **4**, 546–554.—The method is adapted only to saturated vapors, but can be used through a wide range of pressure and temperature. The apparatus consists of a two-liter hard-glass sphere to which are attached a capillary tube for exhausting the air and a larger ⊣-shaped tube in the sealed lower arm of which is placed the metal to be volatilized. The upper arm is then sealed, the bulb is filled with hydrogen or nitrogen and exhausted, the capillary sealed, and the whole heated in a special air-bath whose temperature, kept constant to 1°–2°, is read from a platinum resistance thermometer. The bulb is then cooled, the ⊣-tube cut off, and the deposit of metal on the walls of the bulb dissolved off, and its amount determined analytically. In the case of sodium, it was dissolved in water, and the solution was then titrated with sulphuric acid. In the case of mercury the quantity vaporized was determined by measuring the decrease in height of the liquid mercury in the ⊣-tube, the latter being in this case of fine bore and carefully calibrated.

Results were obtained with sodium between 368°, where the absolute density was 9×10^{-8}, and 420°, where it was 750×10^{-8}. With mercury, the measurements extended from 40° to 325°, and the results agreed well with those of previous determinations by other methods. As no pressure measurements are communicated, the molecular weights cannot be calculated.

A. A. NOYES.

New Osmotic Membranes Prepared by the Electrolytic Process. BY H. N. MORSE. *Am. Chem. J.*, **29**, 173–174.—The purpose of this preliminary note is to state that promising membranes consisting of zinc, cadmium, manganese, or uranyl ferrocyanide, of copper or uranyl phosphate, or of ferric or aluminum hydroxide have been prepared by the electrolytic process previously described (*this Rev.*, 7, 160; **8**, 438).

A. A. NOYES.

The Lowering of the Freezing-point of Aqueous Hydrogen Dioxide Produced by Certain Salts and Acids. BY HARRY C. JONES AND CHARLES G. CARROLL. *Am. Chem. J.*, **28**, 284–291.—The results of Jones, Barnes, and Hyde (*this Rev.*, **8**, 265) showing that salts lower the freezing-point of an approximately 5 per cent. solution of hydrogen dioxide to a less extent than they do that of pure water have been confirmed by a repetition of the experiments with potassium chloride and nitrate and by new ones with ammonium sulphate. It is suggested that this phenomenon may be due to a combination of the peroxide molecules with those of the salt. The effect lies in the opposite direction in the case of sulphuric and oxalic acids, the two acids investigated.

A. A. NOYES.

The Rate of the Reaction between Arsenious Acid and Iodine in Acid Solution; the Rate of the Reverse Reaction; and the Equilibrium between Them. BY J. A. ROEBUCK. *J. Phys. Chem.*, 6, 365–398.—The rate of the first-named reaction at 0° was found, both by following the course of the reaction with definite mixtures and by varying the initial concentrations, to be directly proportional to the concentration of the iodine or I_3' ions (C_A) and to that of the arsenious acid (C_B) and inversely proportional to that of the sulphuric acid present (C_D) and to the square of that of the iodine ions (C_C); that is, $dC/dT = k_1 C_A C_B / C_C^2 C_D$. This is shown to be in accord with the assumptions that the reaction which determines the rate is $(AsO_3)''' + HIO = (AsO_4)''' + H^{\cdot} + I'$, and that the equilibria of the reactions $(I_3)' = I_2 + I'$, and $(I_3)' + (OH)' = HIO + 2I'$ are established instantaneously.

The rate of the reverse reaction, the reduction of arsenic acid by hydriodic acid, was found to be proportional to the concentration of the arsenic acid (C_E), and to increase somewhat more rapidly than the concentration of the iodine ion (C_C) and much more rapidly than that of the sulphuric acid (C_D) when this is concentrated, but nearly in the same proportion when it is dilute, In dilute solution, therefore, the rate is approximately expressed by the equation $dC/dT = k_2 C_C C_D C_E$.

The equilibrium of the reaction was also determined at 0° with the help of a large number of experiments, and was found to be capable of close expression by means of the equation, $K = C_A C_B / C_C^2 C_D^2 C_E$, which is in correspondence with the ionic reaction that actually occurs:

$$(I_3)' + (AsO_3)''' + H_2O = 3I' + 2H^{\cdot} + (AsO_4)'''.$$

The special aim of the investigation was to ascertain whether by equating the empirically found expressions for the rates of the two opposing reactions an expression identical in form with the equilibrium equation would result, as is required by the kinetic theory of chemical equilibrium. The results stated above strikingly show that this is the case. Moreover, the numerical value of the ratio of the two velocity-constants ($k_1/k_2 = 8.6 \times 10^5$) is of the same order of magnitude as the equilibrium-constant ($K = 1.5 \times 10^6$). Two experiments on the rates of the two reactions at 10° and one on their equilibrium at 20° showed that a rise of 10° multiplies the ratio k_1/k_2 by 1.6 and the equilibrium constant K by 1.4, thus by nearly the same amount.

The importance of these results makes it desirable that the investigation be continued with the aim of confirming them and of attaining a closer confirmation of the principles involved, which could probably be done by using the acids themselves (HI and As_2O_3) rather than their salts, by replacing the sulphuric acid by hydrochloric acid, whose dissociation relations are much simpler, and by experimenting only with dilute solutions. A. A. NOYES.

The Rate of Oxidation of Ferrous Salts by Chromic Acid. BY CLARA C. BENSON. *J. Phys. Chem.*, 7, 1–14.—The conclusions are reached that the rate is proportional to the square of the concentration, both of the ferrous salt and of the sulphuric acid, and that it is much reduced by the presence of ferric salts. Uncertain results were obtained as to the effect of the concentration the bichromate. The ferrous salt unoxidized at different periods of the reaction was determined by titrating with sodium arsenite the amount of iodine liberated (through the catalytic action of the ferrous salt) in four minutes after the addition of a potassium iodide solution to the reaction-mixture, comparative experiments being made under nearly the same conditions with known quantities of ferrous salt.

A. A. NOYES.

The Compensation Method of Determining the Rate of Oxidation of Hydrogen Iodide. BY JAMES M. BELL. *J. Phys. Chem.*, 7, 61–83.—The purpose of the work was to determine whether the addition of sodium thiosulphate to the reaction-mixture introduces an error into the determination of the rate of oxidation of hydriodic acid by various oxidizing agents. It was found that this was probably not the case with hydrogen peroxide. Chloric, bromic, and chromic acids, on the other hand, rapidly oxidize the thiosulphate, and, though the rate of this oxidation is less in the presence of iodide, the results obtained by the use of thiosulphate are seriously in error. A few measurements of the effect of varying the concentrations of the oxidizing agent and acid upon the rate of oxidation of the thiosulphate in the absence of iodide did not yield simple or uniform results.

A. A. NOYES.

The Rate of Reaction in Solutions Containing Potassium Iodide, Potassium Chlorate, and Hydrochloric Acid. BY W. C. BRAY. *J. Phys. Chem.*, 7, 92–117.—It is found that the rate of this reaction can be approximately expressed by the equation

$$dC/dT = C^2_{H^\cdot} \times C_{ClO_3'} \times (k_1 C_{I'} + k_2 C_{Cl'}),$$

provided the concentration of the acid ($C_{H^\cdot}$) is between 0.5 and 2 normal and that of the iodide ($C_{I'}$) is between 0.4 and 1 normal. This equation would result if the two following reactions take place simultaneously, and require time for their occurrence,

$$ClO_3' + Cl' + 2H^\cdot = HClO_2 + HClO,$$
$$ClO_3' + I' + 2H^\cdot = HClO_2 + HIO,$$

and if the iodide is then instantaneously oxidized by the $HClO_2$, HClO, or HIO. At smaller concentrations, however, especially of the iodide, this equation does not apply at all; when the concentration of the iodide is decreased from 0.025 to 0.006 normal the rate actually increases, according to the measurements presented.

Free iodine added even to saturation retarded the reaction only 15–20 per cent. On the other hand, the addition of only $^1/_{40}$ as much ferrous sulphate as there was chlorate present increased the rate in one case thirteenfold. A. A. NOYES.

The Speed and Nature of the Action of Bromine on Oxalic Acid. BY THEODORE WILLIAM RICHARDS AND WILFRED NEWSOME STULL. *Proc. Am. Acad.*, **38**, 321–337; *Ztschr. phys. Chem.*, **41**, 544–559.—It was found that the speed of the reaction (measured by the decrease in the bromine concentration) is scarcely affected by varying the oxalic acid concentration from 0.7 to 4 per cent., but that it is greatly increased by neutralization or the addition of a salt of a weak acid and decreased by all strong acids and in an especially high degree by hydrobromic acid. From these facts the authors conclude that it is the C_2O_4'' ion which reacts with Br_2 molecules, and that the removal of the latter by combination with the hydrobromic acid (forming HBr_3) explains the great retardation caused by this acid.

A. A. NOYES.

The Relation between Negative Pressure and Osmotic Pressure. BY GEORGE A. HULETT. *Ztschr. phys. Chem.*, **42**, 353–368.—The author first reviews the experimental investigations on the negative pressure produced in liquid columns, and then discusses the theoretical considerations of Stefan and Tumlirz based on the kinetic theory of vaporization and Van der Waals' equation, from which he concludes that the tenacity of liquids, like alcohol and water, is such that they would withstand a negative pressure of 2,000 to 5,000 atmospheres, if it could be uniformly applied to them.

An experiment, analogous to previous ones by Askenasy, is then described, in which a funnel, whose top is closed with a porous porcelain plate having within it a copper ferrocyanide membrane, is joined to a tube two meters long, whose lower end after the whole is filled with water is dipped under mercury; upon standing, or more rapidly by drawing an air current over the porcelain plate to cause evaporation, the mercury column rose to a height of 1111 mm. or until a negative pressure of 377 mm. was produced. The rise of sap in trees is considered to be a phenomenon of the same kind, depending on the tenacity of the column of sap raised by the evaporation from the leaves and lenticels.

Since in a solution the osmotic pressure acts outwardly against its bounding surface and tends to increase its volume, it can be regarded as a negative pressure; and since it can be shown that submitting a liquid to a negative pressure must decrease its vapor pressure, it is seen why the vapor pressure of a solution is less than that of a pure solvent.

The author then considers the thermodynamic relation between the negative pressure on the liquid and its vapor-pressure, and owing to a minor error in the fourth step of his cyclical process and to his neglecting certain small terms, he obtains an approximate formula instead of the exact one previously derived by the reviewer (*Ztschr. phys. Chem.*, 35, 714). Instead of then placing this negative pressure exactly equal to the osmotic pressure of a solution having the same vapor pressure (which is obviously correct since such a solution could be placed on the semipermeable wall at A in the author's Fig. 3 without disturbing the equilibrium), the author follows the irrational procedure of the earlier deductions, which consists in placing the wall at the *foot* of the osmotic tube so that the osmotic pressure involved is that of a different solution (namely, a compressed one) from the solution whose vapor-pressure is considered. He therefore meets with the usual complications with reference to the volume term.

A. A. NOYES.

On the Iodides of Caesium. BY H. W. FOOTE. *Am. Chem. J.*, 29, 203–212.—The author has proved that CsI_3 and CsI_5 are the only periodides of caesium capable of existing in contact with the aqueous solution either at its freezing-point or at 35.6°, for under this assumption the phase rule requires that there be three and only three constant values of the composition of the saturated solution, even though the excess of iodine over CsI in the solid phase may have any value whatever. These three solubility-values corresponding to the three pairs of solid phases (CsI and CsI_3, CsI_3 and CsI_5, and CsI_5 and I_2) were actually determined, and were proved to be constant when the proportions of the two solid phases were varied, thus showing the absence of intermediate compounds.

A mixture of solid caesium pentaiodide, iodine, and a little water were heated in a dilatometer: at 51.5° a large increase of volume occurred, corresponding to the formation of a new phase consisting of a heavy liquid. Above this temperature one of the two solid phases (CsI_5 or I_2) disappeared, according to which was present in smaller amount. The composition, both of the aqueous phase and of the heavy liquid, corresponding to the presence of each of these two solid phases was determined at 52.2° and 72.6°.

When dry caesium pentiodide and iodine are heated together, whatever may be their relative proportions, the mixture melts at 73° and the liquid produced has a constant composition, again proving the non-existence of higher periodides.

A. A. NOYES.

On Amorphous Sulphur. I. Influence of Amorphous Sulphur on the Freezing-point of Liquid Sulphur. BY ALEXANDER SMITH AND WILLIS B. HOLMES. *Decennial Publications, Univ. of Chicago*, 9, 55–64; *Ztschr. phys. Chem.*, 42, 469–480.—The au-

thors have determined by the Beckmann method the freezing-point of liquid sulphur containing various quantities of amorphous sulphur, which had been produced in it by previous heating of pure sulphur to temperatures above its melting-point. As soon as the freezing-point was obtained, the mass was poured into a cold porcelain dish, and, after standing till the following day to allow the amorphous sulphur present to solidify completely, 10 grams of the pulverized mass were extracted in a Soxhlet apparatus with cold carbon bisulphide which removed all the soluble sulphur, but dissolved of the amorphous sulphur only very small quantities, which were corrected for. Special experiments showed that no considerable conversion of amorphous to soluble sulphur took place during the cooling or subsequent standing.

The lowering of the freezing-point was found to be closely proportional to the quantity of amorphous sulphur present, showing that it forms a true solution. From the heat of fusion, the molar freezing-point lowering for sulphur as a solvent was calculated to be 328°, and with the help of this the molar weight of the amorphous sulphur was found to be 7.75×32 and therefore to correspond nearly to the formula S_8. Hence amorphous sulphur has the same molecular formula as soluble sulphur when the latter is dissolved in various solvents. The melting-point of pure sulphur was found by extrapolation to be 119.25° and a sample was actually prepared so free from amorphous sulphur as to melt at 119.17°. A. A. NOYES.

Reactions between Acid and Basic Amides in Liquid Ammonia. BY EDWARD C. FRANKLIN AND ORIN F. STAFFORD. *Am. Chem. J.*, **28**, 83–107.—In conformity with the previously established fact that both acid and basic amides are good conductors of electricity when dissolved in liquid ammonia, it is now shown that several of them react instantaneously with one another according to the equation

$$K^{\cdot}+NH_2{}'+CH_3CONH'+H^{\cdot}=CH_3CONH'+K^{\cdot}+NH_3,$$

which is completely analogous to the neutralization of acids and bases in aqueous solution. The second hydrogen atom of the acid amides can also be replaced by a potassium atom by direct metathesis with potassium amide. A. A. NOYES.

An Apparatus for Continuous Vacuum Distillation. BY CHARLES F. MABERY. *Proc. Am. Acad.*, **38**, 3–5; *Am. Chem. J.*, **29**, 171–173.—The convenient apparatus developed by the author in connection with his long series of investigations upon petroleum is described in detail. It cannot be briefly explained without the cut which accompanies the article. A. A. NOYES.

Physico-Chemical Investigations in the Pyridine Series. BY E. J. CONSTAM AND JOHN WHITE. *Am. Chem. J.*, **29**, 1–49.—The following thermochemical constants expressed in small calories at 15° were determined:

Substance.	Molar heat of combustion.	Specific heat of vaporization (L).	Trouton constant (ML/T).	Molar boiling-point raising (0.02 T^2/L).	Heat of neutralization.
Pyridine.........	659,200	106.1	21.9	28.4°	4776
α-Picoline	816,100	93.3	21.5	34.6°	5980
β-Picoline	813,100	96.7	21.3	35.8°	5690
γ-Picoline	816,700	....	....	....	....

The heats of combustion and vaporization refer to constant pressure. The heats of neutralization were determined by neutralizing a 0.5 molar aqueous solution of the base with an equally concentrated one of hydrochloric acid. The specific heat capacities at $t°$ were found to be $0.3915 + 0.000484\ t$ for pyridine, and $0.3848 + 0.000774\ t$ for both α- and β-picoline. Compare Ladenburg's results (*this Rev.*, 7, 151).

From these data the following conclusions are drawn. The heats of combustion of the three isomeric picolines are nearly identical, and their mean differs from the heat of combustion of pyridine by the same quantity (156,000 cal.) as do successive homologues in the methane and benzene series. The Trouton constant holds and has about the same value as with other compounds. The specific heat capacities are linear functions of the temperature, but the temperature-coefficients for pyridine and its homologues are not identical, as is approximately the case in other series.

Measurements are also given of the refractive power and density of the four bases. The results agree closely with those of Brühl.

The authors also determined the conductivities at 25° and at different dilutions, of the picrate of each of the four bases when dissolved in pure water and in solutions of the corresponding base (whereby hydrolysis was prevented). From the difference in conductivity the degree of hydrolysis was calculated with the help of the conductivity values for the picric and pyridine or picoline ions, which were themselves derived from new measurements with picric acid and sodium picrate and from those just referred to with pyridine or picoline picrate. The hydrolysis in $^1/_{256}$ molar solution was from 1 to 3 per cent. From the hydrolysis-value and the dissociation-constant of water the dissociation-constants of the bases were calculated by the equilibrium equation given by Arrhenius (*Ztschr. phys. Chem.*, 5, 17), and found to be 3×10^{-9}, 32×10^{-9}, 11×10^{-9}, and 11×10^{-9} for pyridine and for α-, β-, and γ-picoline, respectively. The values for pyridine and α-picoline agree fairly well with those found by Goldschmidt and Salcher (*Ztschr. phys. Chem.*, 29, 116) by a different method. A. A. NOYES.

A Thermochemical Constant. BY F. W. CLARKE. *J. Am. Chem. Soc.*, 24, 882–892; *Ztschr. anorg. Chem.*, 33, 45–57.
A New Law in Thermochemistry. BY FRANK WIGGLESWORTH

CLARKE. *Proc. Washington Acad. of Science*, 5, 1–37.—The first of these articles was a preliminary one, and its substance together with much additional material is included in the second article. It is shown that the molar heat of combustion (K) (when both the hydrocarbon taken and the water formed are gaseous) of the 14 single, double, and triple bonded aliphatic hydrocarbons studied by Thomsen can be expressed by the equation $4K = \text{const.} \times (11c - 8n)$, where c is the number of oxygen molecules consumed in the combustion of 4 molecules, and n is the number of atomic unions in a single molecule (thus, with methane, $c = 8$ and $n = 4$; with acetylene, $c = 10$, $n = 3$). The deviations from the mean value of the constant (13,873) are not greater than 1.6 per cent. except in one case. This equation is interpreted as follows: $8n \times 13{,}800$ cal. represents the heat absorbed by the dissociation of 4 molecules into isolated carbon and hydrogen atoms, and $11c \times 13{,}800$ cal. represents the heat evolved by the combination of these atoms with molecular oxygen; consequently the validity of the equation involves that of the following principles: (1) the heat of formation of a fatty hydrocarbon from the isolated atoms is directly proportional to the number of atomic unions in the molecule and independent of the nature of the atoms; (2) the heat of combination of one isolated carbon atom with oxygen is identical with that of four hydrogen atoms with oxygen.

These principles are also shown to apply to the 20 halogen derivatives investigated by Thomsen, with the single exception of tetrachlormethane; for, in these cases hold true, as closely as before, the equations $4K = 13{,}800\,(11c - 8n + h)$, $4K = 13{,}800\,(11c - 8n + 2h_1)$, and $4K = 13{,}800\,(11c - 8n + 4h_2)$, in which h, h_1, and h_2 represent the number of chlorine, bromine, and iodine molecules, respectively, produced by the combustion of 4 molecules of the halogen compound. Hence, 13,800, $2 \times 13{,}800$, and $4 \times 13{,}800$ calories represent the heat of formation of 1 mol of chlorine, bromine, and iodine from the isolated atoms.

The last-mentioned fact and the integral coefficients of the other quantities, n and c, indicate that 13,800 calories is a unit-quantity of heat, of which some small multiple is involved in every atomic union, and accordingly the author applies to it the special name of ***henotherm*** (from ἑνόω, unite). Thus, it follows from the above equations that the heat of union of an isolated carbon atom with an isolated hydrogen or halogen atom or with another carbon atom (whether singly, doubly, or trebly bonded is immaterial) is 2 henotherms.

A confirmation of these conclusions is furnished by the fact that the heat of addition of bromine in carbon tetrachloride solution to nine double-bonded compounds is 2 henotherms (4 in the case of diallyl), which is what is required by the author's conclusions, since two atomic unions (evolving 4 henotherms) and

the dissociation of one molecule of bromine (absorbing 2 henotherms) takes place; three complex oxygenated compounds give an abnormal heat-effect, however.

Furthermore, it follows that the heat of union of an isolated carbon atom or of four isolated hydrogen atoms with one oxygen molecule is 11 henotherms; this is, however, evidently a composite quantity equal to the difference of the heat of union of one carbon or four hydrogen atoms with isolated oxygen atoms, and the heat of dissociation of the oxygen molecule; and by making the somewhat arbitrary assumption that the latter heat is 1 henotherm, the author concludes that the former is 12 henotherms or 164,400 cal. The fact is also emphasized that the henotherm is nearly identical in value with the neutralization-constant (13,700 cal.) of strong acids and bases, which is the heat effect attending a very simple case of atomic union.

The heats of combustion of ten aliphatic amines are also expressed within 2 per cent. by a formula entirely analogous to that used for the halogen compounds, nine henotherms (123,300 cal.) being taken as the heat of dissociation of the nitrogen molecule. Ammonia forms an exception, so also do the four cyanogen compounds for which data exist, but the heats of combustion of these last can be correctly calculated, if a value of five, instead of two, henotherms be assigned to the union C≡N. Eight sulphur compounds conform to a formula like that used for the amines, a term being introduced to represent the heat of combustion of isolated sulphur atoms.

The simple and mixed ethers conform to the formula used for the hydrocarbons; the heat absorbed by the breaking of each of the unions in C—O—C, therefore, has the same value (2 henotherms) as in the groups C—H, C—Cl, C—Br, C—I, C—C, C=C, C≡C, C—N, and C—S. In the case of other oxygen compounds, however, and of the aromatic compounds, additional constants have to be introduced.

Finally it may be mentioned that the author finds that when his values for the dissociation of the chlorine, bromine, and iodine molecules are added to the heats of combination of the gaseous halogens with various metals and the heats of solution of the resulting salts in water, the sums have an almost identical value in the case of the three different halogens. Thus, the heat effect of these atomic unions is again constant, and the author's dissociation-heats for the three halogens are confirmed.

Whether these empirical formulas are merely mathematical fictions, or whether the author has succeeded in bringing to light real theoretical relationships, can be fully established only by an exhaustive study of the question whether the close agreement of the calculated and observed heat-effects could have arisen solely through the arbitrariness of the choice of even integral numbers of henotherms to represent the various elementary heat effects.

The argument of Loeben (*Ztschr. anorg. Chem.*, **34**, 179) that isomeric substances have somewhat different heats of combustion, proves, to be sure, that the author's principles can not alone furnish an exact explanation of the phenomena, but they may still represent the underlying causes upon which other secondary causes superpose their effects. It should be added that since this abstract was put into print, an article has also appeared by Thomsen (*Ztschr. phys. Chem.*, **43**, 487), in which the validity of the author's conclusions is denied. A. A. NOYES.

References to Papers on Low Temperature Research. BY J. S. SHEARER. *Phys. Rev.*, **15**, 243-254.—A list is given of the titles of the scientific articles published since 1890, describing low temperature work, together with the author's names and journal references. The titles are classified under seven general headings. Under "Chemical Phenomena" are found eight titles.

A. A. NOYES.

A Cell for Measuring the Electrical Resistance of Liquids. BY W. WALTER DINWIDDIE. *Phys. Rev.*, **15**, 237-238.—The cell consists only of a straight, narrow, horizontal glass-tube just a meter long, whose ground ends are inserted by means of corks in much wider tubes in which the electrodes are placed. The mean cross-section of the tube is first determined by weighing it full of water. The cell is intended to enable students to make absolute resistance determinations. A. A. NOYES.

The Electro-Affinity Theory of Abegg and Bodlander. BY JAMES LOCKE. *Am. Chem. J.*, **28**, 403-410.—This article forms a continuation of the discussion of the justification and value of the theory named in the title (see *this Rev.*, **8**, 266, 446). The author reiterates and extends his previous objections to the theory, maintains that these were not removed by the recent reply of Abegg and Bodländer, and contends that these investigators have now admitted that other effects obscure the influence of electro-affinity in so many cases as to make its value as a new principle of chemical systematization very slight.

A. A. NOYES.

Action upon Metals of Solutions of Hydrochloric Acid in Various Solvents. BY HARRISON EASTMAN PATTEN. *J. Phys. Chem.*, **7**, 153-189.—Qualitative statements are made in regard to the action upon twenty different metals of solutions of dry hydrogen chloride in anhydrous chloroform, carbon tetrachloride, ethyl chloride, benzene, silicon chloride, stannic chloride, phosphorus chloride, arsenious chloride, antimony chloride, sulphur chloride, and thionyl chloride. The conclusions drawn are that solutions that have a scarcely appreciable conductivity often act vigorously upon certain metals, especially upon zinc, magnesium, and aluminum, and that the phenomenon is of a highly specific character depending on chemical affinity, and apparently not related to the

electrical conductivity of the solution, to the heat of formation of the metallic chloride, or its solubility. Arguments are also presented against the assumption that ionization is an essential condition of chemical reactivity.

In a postscript the author defends the validity of his own results against the statement made by Professor Remsen in the discussion of the paper, that he had found that upon placing dry zinc in a dry solution of hydrogen chloride in benzene, only a slight evolution of hydrogen occurred and this ceased in less than two minutes, but began again on opening the tube and breathing into it. The author's contention is that the materials used by Professor Remsen, unlike his own, were not completely dry, and that a little water retards the action by hydrating and making pasty the film of zinc chloride upon the metal. He repeated his own experiment in the presence of witnesses with the same result as at first. A. A. NOYES.

Solubility, Electrolytic Conductivity, and Chemical Action in Liquid Hydrocyanic Acid. BY LOUIS KAHLENBERG AND HERMAN SCHLUNDT. *J. Phys. Chem.*, 6, 447–462.—The order of magnitude of the solubility and conductivity of about 150 organic and inorganic substances in liquid hydrocyanic acid is first stated. Quantitative data are presented for the conductivity, at 0° and at various concentrations, of 13 salts, 4 bases, and 7 acids, thus supplementing those of Centnerszwer (*Ztschr. phys. Chem.*, 39, 217). The six potassium salts investigated, and ammonium chloride, have a conductivity two or three times as great as that in aqueous solution under corresponding conditions, while that of silver nitrate is only about one-fourth as great as in aqueous solution. Bismuth and antimony chlorides, pyridine, and acetic, cyanacetic, trichloracetic, and trichlorlactic acids have a conductivity less than 2 per cent. of that of the potassium salts. Hydrochloric and sulphuric acids, and amylamine, strychnine, and morphine are moderately good conductors, but these substances probably all reacted chemically with the solvent, as indeed some of the other substances may have done. In the case of almost all the substances, the molar conductivity increases rapidly with the dilution.

Qualitative statements are made in regard to the action of strong acids dissolved in liquid hydrocyanic acid upon various metals and upon carbonates. A. A. NOYES.

A Study of the Conductivity of Certain Salts in Water, Methyl, Ethyl, and Propyl Alcohols, and in Mixtures of These Solvents. BY HARRY C. JONES AND CHARLES F. LINDSAY. *Am. Chem. J.*, 28, 329–370.—Systematic series of conductivity measurements in water, methyl alcohol, and ethyl alcohol, and mixtures of them were made both at 0° and 25° at dilutions of 32 or 64 to 1024 liters with potassium iodide, ammonium bromide,

strontium iodide, and lithium nitrate. A few measurements were also made with cadmium iodide and ferric chloride in these solvents and with strontium iodide in propyl alcohol and a 50 per cent. mixture of it with water.

In the case of all the salts except cadmium iodide, there is in the methyl alcohol-water mixtures a minimum conductivity. This is pronounced at both temperatures, but much more so at 0° than at 25°. Such a minimum is also shown in the ethyl alcohol-water mixtures at 0°, but not at 25°. The mixtures of methyl and ethyl alcohol do not exhibit this phenomenon, but the conductivity in a 50 per cent. mixture is less than the mean of those in the two pure solvents. It is suggested that assuming the correctness of the hypothesis of Dutoit and Aston, according to which the dissociating power of solvents increases with the association of their molecules, the decrease of conductivity may be due to a diminution of the molecular association of each solvent by the other. Since, however, even, at a dilution of 1024 liters, the maximum decrease of conductivity at 0° in the methyl alcohol-water mixtures is not far from 50 per cent. of the conductivity in pure water or methyl alcohol, the effect produced by mixing the solvents must be due mainly to a large decrease in the migration velocity rather than in the degree of dissociation. It is, to be sure, highly probable that the assumed change in molecular association of the solvents takes place and this is in some way related to the change in migration velocity.

Unfortunately, the authors have not discussed the significance of their valuable experimental material with respect to the two factors—dissociation and migration velocity—upon which conductivity depends, and it is to be hoped that they intend to supply this deficiency in a second paper. It is very important, in view of the present congestion of scientific data, that all investigators fully realize that their quantitative measurements, however carefully made, lose a large part of their scientific value unless the conclusions warranted by them are carefully studied and explicitly stated and summarized. It is also to be regretted that the authors have expressed their results in terms of the nearly obsolete Siemens unit. A. A. Noyes.

On the Electrolytic Preparation of Iodoform from Acetone. By Howe Abbott. *J. Phys. Chem.*, 7, 84–91.—The authors have determined that the conditions under which the best yield of iodoform can be obtained by the electrolysis of an aqueous solution of acetone, potassium iodide, and sodium carbonate, are as follows: temperature, 75°; current density, 0.9–1.35 amperes per sq. dm.; anode solution consisting of 6 grams Na_2CO_3, and 10 grams KI in 100 cc. of water; addition of 5.5 cc. acetone in successive small portions of 0.5 cc. each. Under these conditions the yield was 60 per cent. referred to the electricity used, and 12.3 per cent. referred to the acetone. By reducing to one-fifth the

quantity of acetone, these two yields became 41 and 47 per cent. respectively. A. A. NOYES.

On the Passage of a Direct Current through an Electrolytic Cell. BY S. L. BIGELOW. *J. Phys. Chem.*, 6, 603–629.—In this paper the old problem of continuous conduction through electrolytes at voltages below those requisite for electrochemical decomposition is considered. This question is one which has occupied the attention of physicists since the time of Faraday, the existence of a "metallic" conduction in electrolytes having been often asserted and as often denied. In the present paper the author, after discussing the various views advanced at different times, describes a number of experiments which show that a current will pass for weeks through an electrolyte below the decomposition voltage of water. This current depends upon the quantity of gas (oxygen, hydrogen) dissolved in the solution, and not upon the concentration of the electrolyte. He concludes, therefore, that the current observed is carried not by ions resulting from the dissociation of the electrolyte, but by a form of ions hitherto unrecognized due to the dissolved gases.

The following theory is suggested to explain the phenomenon. A dissolved gas is in a condition analogous to a rarefied gas, some of whose molecules are capable of carrying positive and others negative charges (Thomson). A hydrogen molecule plus a corpuscle of electricity is negatively charged and one minus such a corpuscle is positively charged, the process of solution being sufficient to occasion in some unknown way this ionized or electronized state. The very small current observed below the decomposition voltage of an electrolyte is conducted by these electrified molecules, while in ordinary electrolysis the current is conducted by the ordinary ions. H. M. GOODWIN.

Electrolysis of Water. BY W. R. WHITNEY. *J. Phys. Chem.*, 7, 190–193.—The author maintains that Bigelow's hypothetical explanation (see the preceding abstract) of the passage of a current through water below the decomposition voltages is entirely unnecessary, since that phenomenon is fully accounted for by Helmholz' principle, according to which the back electromotive force at the electrodes diminishes to the limit zero as the pressure of the hydrogen and oxygen gases in contact with them diminishes. Since, when their pressure is less than the external pressure, the hydrogen and oxygen deposited in the electrodes must be removed by the slow processes of diffusion and convection, the decomposition of the water cannot take place rapidly or with visible evolution of gas. The depolarization of the oxygen electrode by the dissolved hydrogen is also an important factor. The author also points out that the phenomenon is not in conflict with the laws of energetics, as Bigelow assumed, for the free energy, though not the total energy, of the gases decreases with their

pressure in the same proportion in which the electrical work required for their production decreases. A. A. NOYES.

On the Inversion of Zinc Sulphate. BY H. T. BARNES AND H. L. COOKE. *J. Phys. Chem.*, 6, 172–177.—In a previous paper (*this Rev.*, 6, 79), it was shown that the inversion temperature of $ZnSO_4.7H_2O$ into $ZnSO_4.6H_2O$ is considerably lower when determined by the electrical method than when determined by direct solubility measurements, the two values being 38.75° and 39.95°, respectively. As the former value has been confirmed by various other investigators, it was thought that the presence of mercurous sulphate in the Clark cell might account for the difference. Experiments show that the inversion temperatures determined with and without the presence of mercurous sulphate differ by a very slight amount, but the values obtained in both cases are less than that given by the solubility method : the difference cannot, therefore, be explained by the presence of this salt. H. M. GOODWIN.

The Electromotive Force of Metals in Solutions of Cyanides. BY S. B. CHRISTY. *Am. Chem. J.*, 27, 354–420.—This article, now published in a place more accessible to chemists, consists of the experimental part of the paper of the same title previously reviewed (*this Rev.*, 7, 195). H. M. GOODWIN.

Liquid Potentiometer: Determining Electrolytic Resistances with Direct Current Instruments. BY CARL HERING. *Western Electrician*, 30, 411.—A method is described for measuring the conductivity of electrolytes with the ordinary Weston instruments with a precision sufficient for commercial work. The current flowing through the electrolyte, which is contained in a rectangular trough, is measured by an ammeter. Two auxiliary electrodes of gold are inserted at a measured distance apart, and the potential between them is balanced by an opposing one, the value of which is determined by a voltmeter. If the cross-section of the tank is also known, the specific resistance of the liquid can then be calculated. H. M. GOODWIN.

On the Theory of the Electrolytic Rectifier. BY K. E. GUTHE. *Phys. Rev.*, 15, 327–335.—The author regards the well-known phenomenon at an aluminum anode as due not as usually assumed, to a high resistance film of aluminum hydroxide, but to the presence of a fluid layer, probably oxygen gas, held in a film of oxide or hydroxide. This layer prevents the passage of the negative ions from the solution of the electrode. This view is supported by a number of experiments : *First*, an increase in temperature increases the current through the electrode ; *Second*, the concentration of the electrolyte is without effect ; *Third*, the nature of the electrolyte is indifferent so long as the reactions at the anode are similar ; thus two sets of observations on solutions

of alum, ferrocyanide of potassium, and zinc sulphate, and on solutions of alum, Rochelle's salt and copper sulphate gave nearly identical polarization curves. An aluminum anode in a chloride solution, however, behaves quite differently, the chlorine acting apparently like hydrogen (when the electrode is used as a cathode). These gases do not appear to be readily retained by the film and hence offer little opposition to the discharge of the ions in the solution.

The film is likened to a kind of semi-permeable membrane. A copper ferrocyanide membrane was shown to block out the current in one direction similar to the aluminum cell. It is suggested that ordinary polarization may also be due to a fluid membrane, consisting of pure water, between the solution and the electrode. H. M. GOODWIN.

Influence of the Solvent in Electrolytic Conduction. BY HARRISON EASTMAN PATTEN. *J. Phys. Chem.*, **6**, 554–601.—This is a lengthy paper, in which the author considers the theory of Arrhenius so inadequate, and the concept of molecular conductivity so unwarranted, that he neither expresses his conductivity measurements on a number of mixed organic solvents in the usual way, nor discusses them from the dissociation point of view. The principal conclusions drawn from his experiments seem to be first, that the lowering of the specific conductivity of non-aqueous solutions by addition of a pure solvent is approximately proportional to the number of mols of solvent added, upon which result a new method of molecular weight determination may be based; second, Konowalow's conclusions (*Wied. Ann.*, **49**, 733) that electrical conductivity increases with the heat effect of the chemical combination between solvent and solute and that the conductivity of aqueous solutions is related to the small molecular volume of water are regarded as untenable; and third, the conduction of electricity by a solvent depends upon the fact that a compound is formed by the solvent and solute when solution takes place, the degree of conductivity depending upon the constituents in this compound and possibly upon their arrangement. Reference must be made to the original paper for further details.

H. M. GOODWIN.

On the Relative Velocities of the Ions in Solutions of Silver Nitrate in Pyridine and Acetonitrile. BY HERMAN SCHLUNDT. *J. Phys. Chem.*, **6**, 159–172.—The transference numbers for silver in acetonitrile and pyridine solutions of silver nitrate were determined by the Nernst and Loeb method, at concentrations varying from one to one-fortieth molar. The values obtained were found to increase in both cases from 0.383 to 0.473, and from 0.326 to 0.440, respectively. The increase is thought to be an example of a general relation exhibited by salts which have a strong affinity for the solvent. H. M. GOODWIN.

Experiments on the Electrolytic Reduction of Potassium Chlorate. By G. H. Burrows. *J. Phys. Chem.*, **6**, 417–426.—Experiments are described on the effect of anode and cathode current densities, temperature, and duration of electrolysis on the reduction of potassium chlorate to chloride with copper electrodes. Calculating the electrical efficiency on the basis that 3×26.8 ampere-hours are required to reduce one mol of potassium chlorate, it was found that with both anode and cathode in the same compartment an efficiency approaching 200 per cent. could be obtained. This is true over quite a wide range of temperature and concentration, and is independent of cathode density. A high current density at the anode is desirable. Presence of free acid rapidly cuts down the efficiency.

To explain this abnormally high efficiency, experiments were carried out with the anode and cathode in separate compartments. A direct reduction of chlorate to chloride to the amount of 58 per cent. was found at the anode, cuprous chloride or copper oxide being formed. Little or no reduction occurred at the cathode, however. If, however, copper sulphate was added before the electrolysis to the cathode portion, a reduction of 91 per cent. was found. This result is in agreement with experiments of Binz on the effect of a zinc anode, or added zinc salt on the efficiency of the electrolytic reduction of indigo. The high efficiency obtained with a single compartment cell is therefore due to the presence at the cathode of copper dissolved at the anode. H. M. Goodwin.

Electrochemical Polarization. By C. J. Reed. *J. Franklin Inst.*, 153, 259.—A general discussion of the phenomena based on the following definition of polarization given by the author: "Polarization is a progressive change in the composition and electromotive force of an electrochemical system necessitated by the progressive exhaustion of one or more of the electrochemical reagents." The article contains nothing essentially new.

H. M. Goodwin.

Electromotive Force of Alloys of Tin, Lead, and Bismuth. By E. S. Shepherd. *J. Phys. Chem.*, 7, 15–17.—The author finds the electromotive force of alloys of tin and bismuth to be the same as that of tin. Mixtures of lead and bismuth, on the other hand, give an electromotive force which changes continuously as the percentage of bismuth changes from 0 to 10 and from 90 to 100, thus confirming the author's previous conclusion (*this Rev.*, 9, 106) that bismuth forms solid solutions with lead, but not with tin. G. N. Lewis.

Electrolytic Preparation of Sodium Amalgam. By E. S. Shepherd. *J. Phys. Chem.*, 7, 29–30.—Sodium is deposited on a cathode consisting in a porous cup containing mercury, and

dipping in the electrolyte. The solid amalgam formed rises to the surface, leaving the path of the current unimpeded. An efficiency of 30–60 per cent. was found with 7 volts and 1 to 4 amperes. G. N. LEWIS.

Reduction of Insoluble Cathodes. BY ALFRED T. WEIGHTMAN. *J. Phys. Chem.*, 7, 18–28.—The author discusses the technical reduction of lead sulphide at the cathode. The yield is good until 95 per cent. of the sulphide is reduced. The sulphides of copper, nickel, and iron give poor yields, as the current evolves hydrogen instead of reducing the ores. The difference is undoubtedly largely due to the high overvoltage of hydrogen on lead. G. N. LEWIS.

The Transition Temperature of Sodic Sulphate Referred Anew to the International Standard. BY THEODORE WILLIAM RICHARDS AND ROGER CLARK WELLS. *Proc. Am. Acad.*, 38, 431–440.—By referring to three new thermometers standardized by the International Bureau, by eliminating the error due to the projecting mercury column and by using several new preparations of sodium sulphate, the authors obtain as the final value of the transition temperature on the hydrogen scale, $32.383° \pm 0.001$. It is shown that as a fixed thermometric point this is at least as good as the freezing-point and better than the boiling-point of water. Since, moreover, it is nearer to the laboratory temperature than either of these points it bids fair to come into general use. G. N. LEWIS.

An Apparatus for the Measurement of the Expansion of Gases by Heat under Constant Pressure. BY THEODORE WILLIAM RICHARDS AND KENNETH LAMARTINE MARK. *Proc. Am. Acad.*, 38, 417–428.—Former investigators have measured chiefly the change of pressure when a gas is heated at constant volume. The authors have constructed an apparatus in which the pressure is kept constant and the thermal expansion is observed. This apparatus consists essentially in a bulb containing the gas, a reservoir for maintaining constant pressure, and a pressure-gauge accurate to 0.01 mm. of mercury. The bulb in which the change of volume occurs is of peculiar construction and is totally immersed in the constant temperature bath. The volume readings are therefore made by electrical contact. The bath is filled with melting ice for the lower temperature, sodium sulphate in transition for the higher. The mean coefficient of expansion of hydrogen between 0° and 32.38° on the hydrogen scale is found to average 0.003659, which is probably accurate to one unit in the last place. The values for nitrogen and carbon dioxide are 0.003660 and 0.003727, respectively. G. N. LEWIS.

A Method for Determining the Index of Refraction of Solid Hydrocarbons with the Pulfrich Refractometer. BY CHARLES

F. MABERY AND LEE SHEPHERD. *Proc. Am. Acad.*, 38, 283–290; *Am. Chem. J.*, 29, 274–281.—The solids were dissolved in a high boiling hydrocarbon and kept at a high constant temperature by coils of wire carrying a current. The refractive indices given by a number of purified paraffin hydrocarbons prepared from different sources were found to agree well with each other and with the theoretical values. G. N. LEWIS.

The Density and Coefficient of Cubical Expansion of Ice. BY J. H. VINCENT. *Phys. Rev.*, 15, 129–153.—This investigation was undertaken especially to throw light on the disputed question of the variability of the density of ice. The method is ingenious. A vessel full of mercury is closed except for a small hole in the bottom. Through this passes a wire connecting a weight pan below with an umbrella-shaped receptacle which holds the ice in the mercury. Water is frozen in this holder, balanced at several temperatures by weights in the pan below, and finally melted and balanced again. As coefficient of cubical expansion the author finds a mean of 0.000152. The mean of four experiments gave 0.9160 as the density of ice, with individual deviations of 0.06 per cent. The author judges that these deviations corroborate the conclusion of Nichols that different kinds of ice have different densities. Unfortunately the experiments seem inconclusive, since the author does not indicate in any way the deviations that may be caused by his method. One would be inclined to attribute the deviations to experimental error rather than to believe that two samples of ice produced under the same conditions differ in density by 0.1 per cent.

This question is of importance in its relation to the ice calorimeter, the accuracy of which, the author concludes from his data, cannot be greater than 0.1 per cent. As a matter of fact, however, since the change of volume on fusion is only about one-tenth of the total volume, a deviation of 0.1 per cent. in the density of the ice would make a difference of almost 1 per cent. in the reading of the calorimeter unless, indeed, the heat of fusion should happen to be less for ice of greater density.

G. N. LEWIS.

The Heat of Vaporization of Air. BY J. S. SHEARER. *Phys. Rev.*, 15, 188–191.—By determining the change in the rate of vaporization of liquid air when a current is passed through an immersed coil, the author finds 50 small calories per gram as the heat of vaporization. This value increases with greater concentration of oxygen. From the equation of Clausius, the author calculates that the heat of vaporization is 45 cal., using the vapor pressure determinations of Olzewski and Baley, and 54 cal., using those of Estreicher. G. N. LEWIS.

Some Optical Properties of Iodine. BY WILLIAM WEBER COBLENTZ. *Phys. Rev.*, **16**, 35–50, 72–93.—The author has compared the absorption spectra of solid iodine, liquid iodine, and iodine in carbon disulphide for visible and for ultra-red light. These spectra contain a number of pronounced bands, but no striking resemblances exist between the three. The pleochroism and abnormal dispersion of solid iodine are also investigated.

G. N. LEWIS.

Solubilities of Some Carbon Compounds and Densities of Their Solutions. BY CLARENCE L. SPEYERS. *Am. J. Sci.*, **164**, 293–302.—The author has determined the solubilities of a number of organic substances in water, methyl, ethyl, and propyl alcohols, toluene and chloroform, at different temperatures. The method is not such as to insure a very close approach to equilibrium between solid phase and solution. The densities of the solutions were also determined; and the author points out that the molecular volumes of all the solutes studied are greatest in water and are less in the other solvents in the order in which these are named above.

G. N. LEWIS.

An Experimental Investigation into the Existence of Free Ions in Aqueous Solutions of Electrolytes. BY JULIUS OLSEN. *Am. J. Sci.*, **164**, 237–248.—The author seems to have attempted to show a permanent heaping up of an excess of ions of one kind by a temporary electrostatic charge or by the application of an electromotive force less than the decomposition voltage. The paper contains many errors, and the results, which are purely qualitative, seem to the reviewer inconclusive.

G. N. LEWIS.

INORGANIC CHEMISTRY.

On Ceric Chromate. BY PHILIP E. BROWNING AND CHARLES P. FLORA. *Am. J. Sci.*, [4], **15**, 177–178.—Ceric chromate has the composition $Ce(CrO_4)_2.2H_2O$. It forms bright scarlet crystals, stable, if dry, below 150°. It is soluble in dilute acids, but gives an orange-yellow basic salt when treated with water.

H. N. MCCOY.

On the Iodides of Caesium. BY H. W. FOOTE. *Am. Chem. J.*, **29**, 203–212.—The author determined the solubility of mixtures of the iodides of caesium in order to show that the only periodides capable of existence, at least within the range of temperatures investigated, are CsI_3 and CsI_5. The composition of the solution, saturated at a fixed temperature, remained unchanged as long as the composition of the solid phases indicated a mixture of iodides containing more iodine than CsI and less than CsI_3. Similarly the saturated solution in contact with mixtures of CsI_3

and CsI_5 was of constant composition, but less concentrated than the preceding. Mixtures of CsI_5 with an excess of iodine showed a constant solubility also. These experiments were conducted at the cryohydric points of the various solutions and at three higher temperatures. The system, pentiodide, iodine and water becomes non-variant at 51.5°, the five phases being vapor, solution, pentiodide, iodine and a heavy liquid. The latter is of constant composition at this transition temperature. If the temperature rises, one or the other of the solid phases disappears. A dry mixture of pentiodide and iodine melts at 73°. At this point this system is non-variant, the four coexisting phases being the two solid phases, vapor and liquid. The composition of this liquid at the transition temperature is constant and independent of the proportions of the solids phases. H. N. McCoy.

On the Existence of Perchromic Acid. By Harrison Eastman Patten. *Am. Chem. J.*, **29**, 385–386.—When saturated potassium bichromate and 2 per cent. hydrogen peroxide are mixed at —16°, a white solid (probably a compound of potassium) separates and the solution turns blue. The ether extract of the blue solution gives with solid sodium acetate a solid which is said to be chromous acetate. The author thinks that the hydrogen peroxide reduces the chromic acid to the chromous state and is thereby changed to a higher oxide than H_2O_2. The experiment is said to render doubtful the existence of perchromic acid.

H. N. McCoy.

A Suggested Explanation of the Reduction of Permanganic Acid by Manganese Peroxide. By J. C. Olsen. *Am. Chem. J.*, **29**, 242–253.—The reduction of permanganic acid by manganese dioxide is accelerated in the presence of acids. The author finds that, for equivalent amounts, nitric acid is about three times as active as sulphuric acid. The results are the same whether the permanganic acid is made electrolytically or is liberated, by acids, from potassium permanganate. For mixtures of nitric and sulphuric acids the acceleration is much smaller than would be expected if the effect were additive. This is especially true for small amounts of sulphuric acid. Thus when 5 per cent. of the nitric acid is replaced by sulphuric acid the speed of the reduction is decreased 38 per cent. It was found that the manganese dioxide formed in the presence of sulphuric acid always carried down some of this acid, but that in nitric acid solution the precipitate formed was free from the latter acid. Morse has concluded that the reduction of permanganic acid by manganese dioxide is due to the removal of dioxide from permanganic acid, owing to the tendency of the former substance to polymerize. The facts just mentioned lead the author to explain the effect of sulphuric acid in retarding the action of nitric acid as due to the formation, to a certain extent, of a compound with the precipitated

manganese dioxide. The result is to decrease the amount of active manganese dioxide. In accord with this view it was found that the precipitate of manganese dioxide contains less sulphuric acid when formed in the presence of a mixture of sulphuric and nitric acids than when formed in a solution containing an equivalent amount of the former acid only. Precipitates of peroxide formed in the presence of nitric acid and little or no sulphuric acid contain an excess of oxygen above that of the dioxide. The author believes that the dioxide is somewhat basic and that, in the absence of sulphuric acid, it unites to a certain extent with permanganic acid. H. N. McCoy.

The Red and Yellow Mercuric Oxides and the Mercuric Oxychlorides. By Eugene P. Schoch. *Am. Chem. J.*, **29**, 319–340.—Mercuric oxide, prepared by precipitation cold, is always yellow in color. When magnified to 1200 diameters it is seen to consist of square tabular crystals. The ordinary red oxide crystallizes in prisms. The crystals of the yellow oxide grow when allowed to remain at the ordinary temperature in contact with the solution from which they were precipitated; at the same time the color of the mass changes from pale yellow to orange, and is, after several weeks, of a decided reddish tint; solutions of sodium or potassium chloride cause a similar change. The two forms of mercuric oxide can not, therefore, be certainly distinguished by the color of the mass. The crystalline form is the decisive feature. The yellow oxide (square tablets) is stable at the ordinary temperature. When it is boiled with solutions of sodium or potassium chloride the color of the mass changes to red and the form of the crystals to prismatic. Dry yellow oxide is also changed to the prismatic form by heating to 250° to 600°. Both forms have approximately the same density, about 11.1. The dissociation tension at 310° is much lower for the red oxide (375 mm.) than for the yellow (760 mm.) At this temperature the latter form rapidly goes into the former and in consequence its tension soon falls. The method of preparation and the behavior of the oxychlorides of mercury were critically studied. Four oxychlorides exist; for these the author proposes the following names: $2\,HgCl_2.HgO$, trimercuroxychloride; $HgCl_2.2HgO$, trimercurdioxychloride; $HgCl_2.3HgO$, tetramercurtrioxychloride; $HgCl_2.4HgO$, pentamercurtetraoxychloride. Each of the last three exists in three forms, making a total of ten modifications. Two of these modifications are prepared only by fusion of mercuric chloride with mercuric oxide. The others are prepared in wet ways. The densities of the oxychlorides are given. H. N. McCoy.

MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

Reconnaissance from Fort Hamlin to Kotzebue Sound, Alaska, by Way of Dall, Kanuti, Allen, and Kowak Rivers. By Walter C. Mendenhall. *U. S. Geol. Survey, Professional Paper No. 10*, 68 pp., maps and plates.—The report gives such information on the natural resources of the country traversed as could be gained during a very hurried trip. Chemical data are wanting. W. F. Hillebrand.

A Newly-Found Meteorite from Mount Vernon, Christian County, Kentucky. By G. P. Merrill. *Am. Geologist*, **31**, 156–158.—The U. S. National Museum has recently acquired a much battered and oxidized pallasite, weighing 159.21 kilos, which will be known as the Mount Vernon meteorite. From the usual pallasites, it differs in being a mass of silicate with a cementing of iron, instead of a spongy iron containing silicate minerals. The silicate (olivine) occurs in large rounded blebs rather than in the sharply angular fragments of the usual pallasite. As in the latter, the olivines are often shattered, with thin films or veinlets of phosphide extending up through them. Analyses will be made. W. F. Hillebrand.

Description of Four Meteorites. By Henry A. Ward. *Proc. Rochester Acad. Sci.*, **4**, 79–88, five plates.—*Andover* (Oxford County, Maine). A stone of no particularly marked characteristics. No analysis. *Cuernavaca* (Morelos, Mexico). An iron with diameters of about 19, 5, and 6 inches. Whitfield's analysis shows: Fe, 88.982; Ni, 10.300. Sp. gr., 7.725. *Arispe* (Sonora, Mexico). An octahedral iron, 272 pounds in weight before cutting, of very irregular outline, notable for the large amount of schreibersite it carries. Troilite nodules are abundant and in a few of them masses of chromite 4-5 millimeters in diameter are to be seen. The etch-figures are very large, the kamacite plates unusually wide, and the taenite films small. Plessite is almost absent. This is one of the limited group of brecciated siderites. Whitfield's analysis shows: Fe, 92.268; Ni, 7 040. Sp. gr., 7.853. Mr. Davison reports a trace of platinum. In the *Proc. Colorado Sci. Soc.*, **7**, 67–68, 1903, is a brief description of this same meteorite by A. F. Wuensch, the name being there spelled Arizpe, and the data taken from Mr. Ward's paper. *Bald Eagle* (near Williamsport, Pennsylvania). Additional data are given concerning this iron, which was first described in the *Am. J. Sci.* for 1892. The main peculiarity, which makes it unique, "is the extremely winding, vermiform assembling of the kamacite plates." W. F. Hillebrand.

Meteoric Iron from N'Goureyma, near Djenne, Province of Macina, Soudan. By E. Cohen. *Am. J. Sci.*, **15**, 254–258, 3

plates. This coarsely granular, shield-shaped iron, weighing $37\frac{1}{2}$ kilograms, is characterized by the presence of an enormous number of small troilites, the peculiar shapes and arrangement of which, together with other peculiarities of form and structure, lead to the belief that the whole mass in its aërial flight must have become so softened as to lose its original octahedral structure. The chemical composition is: Fe, 89.28; Ni, 9.26; Co, 0.60; Cu, 0.04; Cr, 0.11; S, 0.77; P, 0.05; C, 0.04; Cl, 0.01; chromite, 0.09; residue, 0.24. Total, 100.49. The mineral composition is: Nickeliferous iron, 97.28; schreibersite, 0.32; troilite, 1.75; daubreelite, 0.30; lawrencite, 0.02; chromite, 0.09; decomposed silicious grains, 0.24. Sp. gr., 7.672.

W. F. HILLEBRAND.

The Bath Furnace, Kentucky Meteorite. BY HENRY A. WARD. *Am. J. Sci.*, **15**, 316–319, figure.—This aerolite, which fell November 15, 1902, weighs 12 pounds, $13\frac{1}{2}$ ounces, is of 3.48 sp. gr., and presents, so far as yet noticed, "no features of form or of composition which are materially different from others of its class." It is chondritic and may belong with Brezina's intermediate chondrites (CI). No analysis is given.

W. F. HILLEBRAND.

The Mechanics of Igneous Intrusion. BY REGINALD A. DALY. *Am. J. Sci.*, **15**, 269–298.—This is an important contribution to the discussion of the origin of the varieties of igneous rocks. The laccolithic and marginal assimilation theories of plutonic intrusion are not, in the author's opinion, capable of explaining the enormous chambering occasioned by granitic and allied intrusions. To account for this, the theory is developed that the extremely fluid magmas have gradually removed the overlying strata by a process of overhead stoping, the dislodged blocks usually sinking in and being more or less completely absorbed by the magma. The author summarizes his main conclusions as follows: "dikes, sheets, laccoliths, 'bysmaliths,' and perhaps a few of the smaller stock-like, plutonic bodies are conceived to be due to crustal displacement, *permitting* intrusion; in the preparation of the greater and much more important subterranean magma chambers, marginal assimilation is believed to be a true cause, but, in the large, to be quite subordinate to magmatic overhead stoping, while bodily crustal displacement is in but indirect control inasmuch as it only localizes the areas where stoping is to form the chambers; and abyssal assimilation of stoped-out blocks, supplemented by the subordinate marginal assimilation, may be held responsible for the preparation or notable modification of magmas, whence come, through differentiation, most of the igneous rocks of the globe. The plateau-basalts would appear to represent the one widely distributed kind of magma not essentially affected by assimilation."

W. F. HILLEBRAND.

The Geology of Ascutney Mountain, Vermont. BY REGINALD ALDWORTH DALY. *U. S. Geol. Survey Bull.*, **209**, 122 pp., plates.—The irruptive rocks of Ascutney form "a series of true stocks ranging from the oldest, most basic, and least alkaline to the highly alkaline, youngest, and most acid, followed and accompanied by groups of aplitic and lamprophyric dikes," and it is the exhaustive study of these, begun ten years ago, which furnished much of the basis for the theory developed in the paper referred to in the preceding abstract. Seventeen analyses by the reviewer are given of many of these rocks, and of several basic segregations from some of them. To one new type of dike rock the name 'windsorite' has been applied. These analyses are also to be found on page 69 of Bulletin 148, and page 25 of Bulletin 168 of the Geological Survey, where they are given without detailed descriptions. Column L in those publications gives the composition of 'windsorite' and column K should be erased, since the sample submitted to the chemist was unfortunately not what it was intended to be. W. F. HILLEBRAND.

Water in Veins, A Theory. BY T. A. RICKARD. *Eng. and Min. J.*, **75**, 402–403.—Based as it is on numerous underground observations of his own and others, the author feels the suggestion warranted that there is no such deep-reaching zone of saturation as is frequently assumed by geologists, but that the water encountered in mines occupies a comparatively shallow zone beneath which the rocks are dry, as is evidenced by many mines, among them the deepest metal mines in existence. Through fractures, this water may reach lower levels than the normal. "The relation which the ore-forming agencies bear to this water-zone can best be suggested by a simile," which is that of the hot water apparatus of a modern house. The author looks "upon veins as the result of mineral solutions which have received the impulse to circulate by reason of thermal activity, itself a phase of volcanic energy; so that from the base to the top of the circulatory system there is every gradation from an igneous solution of mineral matter, through all the intermediate aqueous-igneous reactions until at the upper end of the cycle of changes there is simple aqueous precipitation, many times repeated, and culminating finally in the formation of the ore-bodies. * * * "

W. F. HILLEBRAND.

ANALYTICAL CHEMISTRY.

An Accurate Estimation of Sulphur in Iron by the Evolution Method. BY HARRY E. WALTERS AND ROBERT MILLER. *Proc. Eng. Soc. W. Penn.*, **18**, 83–86.—Determinations of sulphur by the evolution method in samples of coke, and of foundry and cast-irons which had been annealed by heating for fifteen minutes in a current of natural gas or hydrogen in a combustion

tube, were found to agree exactly with results obtained for sulphur by the gravimetric method. Samples containing an appreciable amount of titanium should be annealed for half an hour.

Shot samples that had been heated to redness before being crushed, gave closely agreeing results before and after being annealed, but in nearly all other cases the results obtained for sulphur were appreciably higher after annealing the samples.

B. S. CUSHMAN.

The Double Ammonium Phosphates in Analysis. BY MARTHA AUSTIN. *Am. J. Sci.*, **164**, 156–160.—The author shows that criticisms of her earlier articles on the precipitation of the double ammonium phosphates are themselves open to objection because of the use by the other chemists of hydrous (serpentine) asbestos. This disintegrates when heated, is readily attacked by many reagents, and contaminates the precipitates when they are washed with a 1 per cent. solution of ammonium phosphate followed by alcohol. Even a thin felt of anhydrous asbestos showed a constant increase in weight when washed with these solutions.

B. S. CUSHMAN.

Further Notes on Cement Testing. BY S. F. PECKHAM. *J. Soc. Chem. Ind.*, **21**, 831–832.—Ultimate analysis should never be used for determining the relative value of cements for it may show no difference between cements having very unlike properties. The silica, alumina, and iron that exist in a cement as sand or fuel ash or overburned ferric oxide form no part of the cementing material. They can be separated from the cement proper by a careful solution of the latter in 10 per cent. hydrochloric acid.

B. S. CUSHMAN.

The Estimation of Bromic Acid by the Direct Action of Arsenious Acid. BY F. A. GOOCH AND J. C. BLAKE. *Am. J. Sci.*, **164**, 285–292.—The oxidizing power of a bromate can be determined by boiling it in solution with a known excess of arsenious oxide and an excess of sulphuric acid and determining the amount of arsenious oxide remaining unchanged. Chlorates are scarcely affected by this treatment.

B. S. CUSHMAN.

The Chemical Assay of Lead Ores. BY A. W. WARWICK. *Proc. Colorado Sci. Soc.*, **7**, 73–75, 1903.—A plea for the general adoption of a more accurate method for the valuation of lead ores, especially poor ores, than that by fire assay.

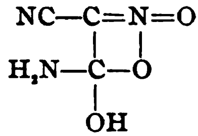
W. F. HILLEBRAND.

ORGANIC CHEMISTRY.

On the Oximes of Nitromalonic Aldehyde. BY HENRY B. HILL AND WILLIAM J. HALE. *Am. Chem. J.*, **29**, 253–274.—*Salts of nitromalonic dialdoxime.* By dissolving the sodium salt of nitro-

malonic aldehyde in a concentrated solution of hydroxylamine hydrochloride containing a slight excess of sodium carbonate, a pale-yellow *mono-sodium salt* of the dioxime separates. By the action of alkali upon this mono-sodium salt followed by precipitation with alcohol, a yellow crystalline *di-sodium salt* is obtained. A solution of the latter precipitated by silver nitrate gives a voluminous yellow precipitate of the corresponding *silver salt*, which blackens rapidly in the light (while the mono-silver salt is very stable). *Nitromalonic dialdoxime* could not be isolated from its salts on account of its instability, although it was shown that it exists for a short time in dilute aqueous solution. The products of its spontaneous decomposition are β-nitroisoxazole, fulminuric acid, a small amount of a substance isomeric with the latter, and hydroxylamine. The appearance of fulminuric acid among the decomposition products of this dioxime is a confirmation of the formula assigned to the former by Steiner and Nef, $H_2N.CO.C(:NO.OH)CN$. *Nitromalonic diacetyldialdoxime.* When an alkaline solution of the sodium salt of nitromalonic dialdoxime is shaken with acetic anhydride, the sodium salt of the diacetyl derivative separates, and, when recrystallized from alcohol, forms small obliquely truncated prisms, melting with decomposition at about 136°–138°. Suspended in ether and acidified with hydrochloric acid, it gives the free diacetyldialdoxime, which crystallizes in fine colorless needles, m. p. 64°–66°, while if it is warmed with two molecules of caustic alkali, the alkaline salt of a new *acid*, isomeric with fulminuric, is produced. *Nitromalonic acetylaldoxime nitrile.* The sodium salt of the diacetyldioxime is decomposed by dissolving it in warm water, and, on cooling, crystals of the acetylaldoxime nitrile are deposited. On recrystallization these appear as long pointed prisms, m. p. 87°–88° (corr.). The substance dissolves freely in hot water, and at 70°–100° is changed (best in presence of a little hydrochloric acid) to nitromalonic aldoxime nitrile. In alkaline solutions, salts of the aldoxime nitrile are formed immediately. *Nitromalonic aldoxime nitrile* is prepared from the diacetyldioxime or its alkaline salts, by the loss of two molecules of acetic acid, the monacetyl monoxime being the intermediate product. It crystallizes in long colorless needles, or in prisms, m. p. 143°–144° (corr.). It is quite stable to mineral acids, but is converted to fulminuric acid by heating its alkaline solution. With acetic anhydride the acetyl derivative is formed. It gives two series of salts, the secondary being changed to the primary by the action of carbon dioxide; the *dibarium* and *mono-silver salts* crystallize in pale-yellow needles. The addition of aniline chloride to the alkaline solution of the oxime nitrile gives the nitromalonic nitrile anile. If the solution of a secondary salt be acidified with two molecules of hydrochloric acid, long slender needles gradually separate, isomeric with the oxime nitrile and with fulminuric acid, and identical

with the substance formed in small amount by the spontaneous decomposition of the dioxime. This latter substance changes very readily to fulminuric acid, and the following formula is suggested for it :



Nitromalonic acetylaldoxime anil is formed by the action of acetic anhydride upon the aldoxime anile, or by the action of aniline chloride upon the sodium salt of the diacetyldioxime. The acetylaldoxime anile is insoluble in water and is slowly decomposed when boiled with it. It crystallizes from glacial acetic acid in yellow needles or prisms, and when recrystallized from alcohol and carbon disulphide, melts at 115°–116° (corr.). *Nitromalonic nitrile anile*, $C_6H_5N:CH.C(:NO.OH)CN$, may be obtained from the aldoxime anile by long heating with the Beckmann mixture or by the action of aniline chloride upon an alkaline solution of the aldoxime nitrile, but is more conveniently prepared by the action of aniline upon an alcoholic solution of β-nitroisoxazole. The nitrile anile forms short yellow prisms, m. p. 208° (uncorr.) (from glacial acetic acid), 209°–210° (uncorr.) or 215°–216° (corr.) (from ethyl acetate). *Reactions with phenylhydrazine.* The chief products of the action of phenylhydrazine upon an alcoholic solution of β-nitroisoxazole are 1-phenyl-4-nitropyrazole and hydroxylamine. The addition of phenylhydrazine chloride to an aqueous solution of the sodium salt of nitromalonic dialdoxime gives the same phenylnitropyrazole. *The action of water upon β-nitroisoxazole.* β-Nitroisoxazole, on standing in cold aqueous solution, turns yellow and acquires an acid reaction. The addition of aniline acetate to this acid solution throws down an abundant precipitate of nitromalonic nitrile anile, but if the solution be made alkaline before the addition of the aniline acetate, nitromalonic aldoxime anile is formed. If the aqueous solution of the isoxazole be heated, or allowed to stand for a long time at the ordinary temperature, a different change is observed, two molecules of the nitromalonic aldehyde monoxime first formed condensing with elimination of formic acid. The following formula is suggested for the product: $NC.C(NO_2):CH.C(:NO.OH)CN$.

M. T. Bogert.

Remark upon the Communication of Mr. J. Svoboda "On an Abnormal Course of the Michael Condensation." By Arthur Michael. *Ber. d. chem. Ges.*, **36**, 763.—In the *Monatsh. Chem.* (**23**, 842), J. Svoboda makes a communication upon a ketopentamethylene derivative which should result from the interaction of sodium methylmalonic ester and citraconic ester.

Svoboda has overlooked the fact that Michael has already reported upon this reaction (*Ber. d. chem. Ges.*, 33, 3736 (1900)), showing that, instead of a ketopentamethylene derivative, a ketotetramethylene derivative is formed, and further that the reaction is still being investigated in Michael's laboratory.

M. T. BOGERT.

On Certain Derivatives of Picric Acid. BY C. LORING JACKSON AND R. B. EARLE. *Am. Chem. J.*, 29, 212–215.—*Picryl bromide* (1-brom-2,4,6-trinitrobenzene) is prepared by boiling 1-brom-2,4-dinitrobenzene with a mixture of fuming nitric and fuming sulphuric acids. The yield is about twenty-five per cent. of the theoretical. Large yellowish white crystals (from alcohol), m. p. 122°–123°, soluble in most of the ordinary solvents except water. Sodium methylate changes it to trinitroanisol. *Phenyl picrate*, from sodium phenolate and picryl chloride, crystallizes from a mixture of alcohol and benzene in short thick yellowish prisms, m. p. 153°, insoluble in water or ligroin, soluble in the other ordinary solvents. By adding a benzene solution of phenyl picrate to an absolute alcohol solution of sodium acetoacetic ester, picryl acetoacetic ester is formed. *4-Brom-2-nitrophenyl picrate*, from picryl chloride and the sodium salt of 4-brom-2-nitrophenol, crystallizes from acetone in short, thick, yellowish white prisms, m. p. 232°, and shows about the same solubilities as phenyl picrate.

M. T. BOGERT.

On Symmetrical Dinitrobenzolsulphonic Acid. BY C. LORING JACKSON AND R. B. EARLE. *Am. Chem. J.*, 29, 216–225.—1,3,5-Dinitroaniline was diazotized, the diazonium chloride changed to the diazoxanthogenic ester, and the oil obtained by heating the latter was then oxidized direct with nitric acid. The crude sulpho acid thus produced was purified by conversion to its barium salt, and the latter was changed to the sulphochloride by the action of phosphorus pentachloride. *1,5-Dinitrobenzene-5-sulphochloride* crystallizes from chloroform and ligroin in flat, yellowish white prisms, m. p. 98°–99°, soluble in benzene, chloroform or glacial acetic acid, insoluble in water or ligroin, and is quite stable to hot water, but rapidly decomposed by hot alcohol. *1,3-Dinitrobenzene-5-sulphamide*, obtained from the chloride by the action of strong ammonia water, crystallizes from dilute alcohol in short, slender, yellowish prisms, m. p. 234°–235°, soluble in hot water or in hot alcohol, practically insoluble in cold water, slightly soluble in ether, benzene, chloroform, glacial acetic acid or ligroin. *1,3 Dinitro-5-sulphobenzene*, $C_6H_3(NO_2)_2SO_3H$, prepared by boiling the sulphochloride with water, separates from the water in large white crystals. Its *barium salt* crystallizes from water in pale yellowish prisms, containing 3 molecules of water, part of which is lost on standing over sulphuric acid; it is soluble in alcohol; 100 parts of its aqueous solution contain

4.4 parts of the anhydrous salt. 1,3-Dinitro-5-sulphobenzene is identical with the acid obtained by Limpricht by nitrating *m*-nitrobenzenesulphonic acid, although Sachse decided that Limpricht's acid was the vicinal isomer. The authors prepared Limpricht's acid by Sachse's method, and found its barium salt corresponded exactly in appearance, water of crystallization and solubility, with the barium salt noted above. Sachse's proof of the constitution of this acid rests upon the reduction of the dinitrosulpho acid to the diaminosulpho acid, changing this to the dibromsulpho acid by the diazo reaction, and identifying the latter by the melting-point of its chloride and amide. The authors repeated Sachse's work, but obtained the symmetrical dibromsulpho acid instead of the vicinal isomer reported by Sachse.

M. T. BOGERT.

BIOLOGICAL CHEMISTRY.

On the Biological Relationship of Proteids and on Proteid Assimilation. By P. A. LEVENE. *N. Y. Med. Record*, 63, 495.—This is a preliminary communication of the work of the author in this field. It was observed that if the serum of an animal acquired the power to form precipitins with one proteid of an animal of a different species, it had the power to form precipitins also with other proteids of the same animal or animals closely related to it. The conclusion drawn from this observation is that proteids have not only a chemical but possess also a biological individuality. Thus, chemically, all serum-albumins are identical, biologically they are different. From the latter standpoint they may be regarded as isomers. Chemically different albumin, globulin, casein, etc., derived from the same animal may be regarded as having at least one part common to all, or, perhaps, may be regarded as derivatives of one substance, which is the nucleus of the proteid material of that animal. Another observation made, and one which corroborates the above hypothesis, is that a precipitin active for a given proteid is capable of forming precipitins with the primary digestive products of the latter and *vice versa*.

F. P. UNDERHILL.

On the Heat Lability of the Complements of Cold-Blooded Animals. BY HIDEYO NOGUCHI. *J. Med. Research*, 9 (new series 4), pp. 169–173.—The serum complements of cold-blooded animals are highly labile bodies and are destroyed at temperatures below 50° C. The serum complements of those animals would appear to be multiple in that their action upon different species of red corpuscles is not only different, but the destruction of the complement for one kind of red corpuscle may be effected without loss of the entire complement-content of the serum. The complements for given kinds of red corpuscles can be greatly re-

duced without being entirely destroyed by heating the serum. When such reduction is brought about, a slightly higher temperature completely abolishes the action of the complements. The complements occurring in different sera show, for a given species of red corpuscle, different degrees of heat lability.

F. P. UNDERHILL.

On the Multiplicity of the Serum Hemagglutinins of Cold-Blooded Animals. BY HIDEYO NOGUCHI. *J. Med. Research*, 9 (new series 4), pp. 165–169.—On the basis of the experiments recorded in this paper the author has drawn the following conclusions: the serum of *Limulus polyphemus* contains several and perhaps many agglutinins which are, in part at least, specific for certain erythrocytes. The agglutinins show varying degrees of heat lability, although temperatures of 40° C., when continued for thirty minutes, diminish the activity of all agglutinins. Temperatures approaching 65° C., seem to destroy wholly the agglutinating power of the serum for erythrocytes. The complete absorption of agglutinins for the corpuscles of one or several species of animals from *Limulus* serum leaves the remainder of the agglutinins in almost undiminished quantity. A slight difference, in the case of certain erythrocytes, has been noted in the rapidity with which the reaction is completed in the serum from which a part of the agglutinins has been removed. The serum of *Mustelus canis*, in so far as its agglutinins are concerned, agrees in its action with that of *Limulus*. *Limulus* and *Mustelus* sera contain a multiplicity of agglutinins for erythrocytes of cold-blooded animals.

F. P. UNDERHILL.

III. A Contribution to the Chemistry of American Cheddar Cheese. BY LUCIUS L. VAN SLYKE AND EDWIN B. HART. *Am. Chem. J.*, **29**, 371–385.—The results obtained in this research show that paranuclein is a common constituent of all cheeses examined. In cheese four and one-half months old, the three basic products, lysatine, histidine, and lysine, were found, and in cheese fifteen months old tetramethylenediamine (putrescine) and lysine were present. In no case could arginine be isolated. There appears to be good evidence that there is regularly in the cheese-ripening process, in the case of hard cheeses like Emmenthaler and American cheddar, a conversion of primary into secondary amido compounds, and these chemical changes may explain, perhaps, the gradual development of flavor in normal cheese.

F. P. UNDERHILL.

Quick Methods for Crystallizing Oxyhaemoglobin: Inhibitory and Accelerator Phenomena, etc.; Changes in the Form of Crystallization. BY EDWARD T. REICHERT. *Am. J. Physiol.*, **9**, 97–100.—If to blood, before or after laking, from 1 to 5 per cent. of ammonium oxalate is added, crystallization of the

oxyhaemoglobin begins immediately, and a quantity of crystals can be obtained within a few hours at ordinary temperature. Dogs, rats, guinea-pigs, and necturus blood give satisfactory results with this method, but the blood of the horse does not. The rapidity of crystallization varies with the method of laking and the percentage of oxalate. If to the blood of one species, the blood, plasma, or serum of another species be added, the laking of the blood may be retarded, accelerated, or unaffected, according to the character of the mixture. The period for laking may be prolonged for five minutes or more. The typical forms of the crystals of certain kinds of oxyhaemoglobin may be modified or completely changed when the bloods of two different species are mixed.

F. P. UNDERHILL.

The Influence of Cold on the Action of Some Haemolytic Agents. BY G. N. STEWART. *Am. J. Physiol.*, 9, 72–97.—At 0° C. the laking action of sapotoxin is much retarded, and it can be shown that before any haemoglobin has been liberated the conductivity of the blood is increased, presumably owing to an increase in the permeability of the envelopes of the corpuscles to electrolytes. At this stage sapotoxin has been fixed by the corpuscles. Bile salts produce the phenomenon less distinctly, foreign serum not at all. Both at 0° and at ordinary temperature a dose of sapotoxin just sufficient to cause liberation of the haemoglobin causes the discharge of only a small proportion of the electrolytes of the corpuscles. When the dose is increased, the electrolytes are discharged. It seems permissible to divide the action of sapotoxin into three stages: (1) An action on the envelope which does not necessarily nor immediately lead to the liberation of the haemoglobin; (2) an action on the haemoglobin or the stroma which causes the discharge of the pigment; (3) an action on the stroma leading to the setting-free of electrolytes.

F. P. UNDERHILL.

The Specific Rotation of the Nucleic Acid of the Wheat Embryo. BY THOMAS B. OSBORNE. *Am. J. Physiol.*, 9, 69–72. —The specific rotation was determined by suspending the dry acid in water and gradually adding decinormal potassium hydroxide solution until all was dissolved. In this way a perfectly clear solution was obtained which reacted strongly acid with litmus and contained the nucleic acid as acid potassium nucleate.

The results show that with 0.0236 gram nucleic acid per cubic centimeter $[\alpha]_D^{20°} = +66.95°$; with 0.04 gram per cubic centimeter of nucleic acid $[\alpha]_D^{20°} = +73°$. The solutions showed no change in rotation after standing twenty-four hours. From the results given it is seen that nucleic acid is strongly dextrorotatory and that the degree of rotation is considerably influenced by the concentration of the solution. Other experiments show that a combination of protein with nucleic acid may show strong polar-

ization, and that this dextrorotation may be wholly due to the nucleic acid component. In the recent work of Gamgee and Jones (*Am. J. Physiol.*, 8, 447) the figures given for the specific rotation for most of the nucleo-proteids examined are such as might be caused by the dextrorotation of the nucleic acid.

F. P. UNDERHILL.

SANITARY CHEMISTRY.

Sewage Work; A Twenty-five Year Review. BY RUDOLPH HERING. *Eng. Record*, 47, 21.—The development of sewerage engineering in America during the past twenty-five years has been very rapid. Twenty-five years ago sewage work in this country was in its infancy. New York, Brooklyn, Chicago, Philadelphia, and Providence had sewerage systems, but crude as to design and construction. Boston was just beginning to construct a main drainage system. Sewage treatment was just beginning to be discussed. In 1882 the first large area for sewage irrigation was laid out in Pullman, Illinois, and in 1889 the first plant for chemical treatment in this country, was constructed at Worcester, Massachusetts. To-day, not only almost every city, but a very large number of small towns, have well devised and constructed sewerage systems, and there are over one hundred plants in this country for the treatment of sewage of cities and towns, and if plants for small places are included, the number reaches several hundred.

LEONARD P. KINNICUTT.

Abatement of the Smoke Nuisance. Report by Committee. Engineers' Society of Western New York. *Jour. Ass. Eng. Soc.*, 30, 41–49, 1903.—This report is local in character, referring merely to the abatement of the smoke nuisance in the city of Buffalo, N. Y. Accompanying the report is a list of articles that have appeared on the subject of the smoke nuisance, in various American journals and magazines.

LEONARD P. KINNICUTT.

Slow Sand Filtration Plant for Washington, D. C. BY J. S. SCHULTZ. *Eng. Record*, 47, pp. 269–273.—The water supply of the city of Washington is taken directly from the Potomac river, a river subject to frequent and sudden floods, and contaminated by surface drainage, the result being that the water is often very turbid, and, as shown by chemical and bacterial tests, contaminated by sewage. As early as 1874 attention was called to the objectionable character of the water, but it was not until 1894 that the matter was laid before congress. In December, 1900, the senate directed the Committee on District Affairs to investigate and report on the relative cost of the mechanical and slow sand filtration systems for Washington, the result being the adoption of the sand filtration. The plant which is now to be

built, and which it is hoped will be in operation by December 1, 1904, is, in outline, as follows: The intake will be, as it is at present, at Great Falls, 17 miles above the city; the water will be conveyed, as now, to the Washington City Reservoir, which will serve as a sedimentation basin, from whence the water will be pumped to the filter beds with a normal lift of 22 feet. The plans contemplate 29 one-acre filter beds, the total filtering capacity of which is calculated at 75,000,000 gallons per day, though only 24 beds are to be built at once. The beds are to contain 3 feet of sand and 1 foot of gravel. The clear water, collected by the underdrains, is carried to the pressure regulating houses, similar to those designed for Pittsburg, and thence to the clear water basin designed for a capacity of 14,000,000 gallons. The article gives plans showing sizes and locations of the various parts of the plants and a few extracts from the specifications, which are similar to those for the Pittsburg filter. The cost of filtration, after the plant is completed, is estimated at $6 per 1,000,000 gallons. The amount of water used at Washington is very large, equaling 205 gallons per capita, daily, making the total amount 60,000,000 gallons. LEONARD P. KINNICUTT.

Report on Improved Water Supply for Toledo, Ohio. *Eng. Record*, 47, 324.—The population of Toledo in 1900 was 132,000, and the daily per capita consumption was 63 gallons. The present supply is drawn from the Maumee river. The water is frequently turbid, seriously polluted, and condemned as unsafe. In August, 1902, the trustees of the Toledo Water Works appointed a commission, consisting of C. H. Brenzenbery, Allen Hazen and W. G. Clark, to determine the best method of securing an ample supply of pure and wholesome water. The committee, after making a careful study of all possible sources of supply, recommended that the Maumee river should still be the source of supply, and as a coagulant would have to be added to remove the turbidity and covered filters would be necessary, advised that the water be purified by mechanical filtration rather than by slow sand filtration. LEONARD P. KINNICUTT.

Residential Septic Tanks. BY LEONARD METCALF. *Eng. Record*, 47, 36.—The author, in discussing the subject of private residential tanks, shows in the first place, that for a community of 1000 inhabitants the cost of one central septic tank should not be more than one-third to one-quarter of the aggregate cost of residential septic tanks; and for a community of 5000 persons, not over one-fifth. Beside the question of cost, he believes that, as a general proposition, sanitarians would agree that it is far wiser to remove all sewage at once from the center of a community and treat it at a distance from human habitations. As to the septic tank itself, the writer believes it is in many cases a valuable adjunct to the present methods of sewage disposal, but that the

use of the septic tank is not advantageous in all cases, especially with a sewage in which a large amount of anaërobic action has taken place in the sewers before the sewage reaches the tank. Further, septic tank sewage is generally more offensive than fresh sewage, the sludge much fouler than the sludge from fresh sewage, and the periodic cleaning out of the tank more difficult, not only on account of the fouler sludge, but on account of the tenacious character of the mat which is sometimes found in the tank, which in one case that came to the attention of the author, was so thick and tough that it could not readily be broken up even by a powerful fire stream, and the offensive character of the material made it impossible, if not actually dangerous, to send a man into the tank to break up this mat.

LEONARD P. KINNICUTT.

Discharge of Sewage into Dublin Harbor, Ireland. BY WILLIAM J. PARRY AND WALTER E. ADENEY. *Eng. Record*, 47, 177.—The writers have made a careful study of the effect of the discharge of the sewage of Dublin, and the neighboring townships, into Dublin Harbor, and as a result have arrived at the following conclusions: That heavy solids and floating substances should be removed from the sewage before discharging it into the harbor. That the discharge should be made into a deep definite water channel, with current setting seaward. That the width of the water in the channel at low tide must be sufficient for adequate dilution of the sewage. That in calm weather the surface water alone is affected by the discharge of sewage into it, and that the bed of the channel is not fouled, provided heavy solids are intercepted before the sewage is discharged. That the sewage will become rapidly diluted with about eight to ten times its volume of clean water, but that further dilution or dispersion proceeds far less rapidly, except in stormy weather.

LEONARD P. KINNICUTT.

The Physical Properties of Water. BY ALLEN HAZEN. *Jour. New England Water Works Ass.*, 17, pp. 21–28 (1903).—The physical properties referred to are those that effect the value of a water for a water supply, *i. e.*, color and turbidity. The writer describes the portable apparatus which he has designed, at the request of F. H. Newell, hydrographer of the U. S. Geological Survey, for determining color and turbidity. For color determination the apparatus consists of aluminum tubes, with glass ends and glass slips, the standard tube being 200 millimeters long. The glass slips are made of glass having the color of the standard platinum-cobalt solution, and are of various thicknesses. These disks are mounted in aluminum, and are compared directly with a standard platinum-cobalt solution in an apparatus designed for the purpose, and the value of each, thus determined, is stamped upon the aluminum mounting, the figure representing

the parts per million of metallic platinum which would produce an equal color when seen in a standard tube 200 millimeters long. In making determinations of color, the water to be examined is placed in one standard tube, and disks are placed singly or two at a time, at the end of an empty standard tube so that the color is like the color of the water in the second tube. The amount of color of the water is the amount or sum of the amounts stamped on the disks.

For determining degree of turbidity, the platinum wire method, with the graduation recommended by Mr. G. C. Whipple and the author, is adopted. In using the stick method the eye is always supposed to be 1.2 meters from the wire. A straight stick of this length is not convenient for field work, and the apparatus to determine the turbidity is a short aluminum bar with a platinum wire at the beginning of the graduation ; the rest of the graduation is on a tape containing bronze wires to prevent stretching, and attached so that when not in use it folds around the aluminum bar. To hold it stiff in running water, there is a catch to which can be attached any rough stick which may be picked up on the ground at the place where the determination is being made. In the discussion which follows the paper, Mr. R. S. Weston describes the diaphanometer, used for determining turbidity, consisting of a tube 40 inches long and 1.2 inches in diameter, supported on a box containing the illuminating apparatus. At the lower end of the tube there is an object glass, the four quadrants of which are partially blackened in such a manner as to leave a transparent cross with arms 1 millimeter wide. The cross of light corresponds to the wire in the platinum wire method, and the turbidity is determined by noting the vanishing point of the cross when the same is viewed against a strong light. The illuminating apparatus consists of a Welsbach light, the rays of which pass through a double plano-convex condenser and are reflected up the tube through an inclined convex mirror. A table is also given by Mr. Weston, showing the relation between turbidity determinations made by "Silica Standard" by "Diaphanometer" and by "Platinum Wire."

LEONARD P. KINNICUTT.

The Action of Vaporized Formaldehyde and Vaporized Carbolic Acid as Gaseous Disinfectants. BY H. W. HILL. *Jour. Mass. Ass. Boards of Health*, 13, 24.—The germicidal effects of sulphur dioxide and formaline depend, to a great extent, on the presence of moisture, and if the humidity of the air, in the room which is to be disinfected, is low, very much more gas is required than if the humidity is at the saturation point. A series of experiments with carbolic acid showed that carbolic acid vapor will kill the diphtheria bacillus, equally as well as formaldehyde, when used under the same con-

ditions, and that the germicidal effect of bichloride of mercury vapor, which has been used in France, when the air is saturated with moisture, is stronger than either formaldehyde or carbolic acid. LEONARD P. KINNICUTT.

Purification of Public Water Supplies. BY L. E. CHAPIN. *Ohio Sanitary Bulletin*, 7, 81–91.—Statistics from many localities show that a water-shed having a population of 25 or more to the square mile, gives a water supply open to suspicion as being or liable to be contaminated. And with a density such as that of most Ohio water-sheds, of 50 or more, the purity of the supply is doubtful if not absolutely certain of contamination. Taking the typhoid fever data for 1900, it is found that the death-rate in Ohio cities and towns, per 100,000 of the inhabitants, is as follows: Towns obtaining water supply from inland rivers, streams, and lakes, 10 in number, death-rate 58; from lake Erie, 4 towns, death-rate 52; from the Ohio river, 11 towns, death-rate 44; from well and ground waters, 12 towns, death-rate 39; from ground waters together with rivers and creeks, 16 towns, death-rate 35; from impounded reservoirs, 5 towns, death-rate 20; from Lake Erie, after filtration, 1 town, death-rate $12^1/_2$. These figures may be taken as a measure of the contamination of the water supplied to Ohio towns and cities, and shows that radical measures should be taken to obtain a pure water supply. By sedimentation alone, when the water is stored in large clean basins, a large per cent. of the pathogenic germs are removed, as is shown by the low death-rate of towns using impounded reservoirs. Filtration of a water supply either by a slow sand or a mechanical filter will, on a conservative estimate, reduce the death-rate from typhoid fever 50 per cent., and will save from 22 to 29 lives per each 100,000 of the population. The cost of slow sand filtration plants varies according to the location, price of labor and materials, from $50,000 to $100,000 per net acre of filtering area, while the mechanical filtration plant is from $10,000 to $25,000 per million gallons capacity, or from 50 to 60 per cent. of the cost of a slow sand filtration plant, when capacities are compared. The annual cost of operation varies according to local conditions. Slow sand filtration at Albany, a 15,000,000-gallon plant, costs $1.66 per million gallons, while other statements give $2.76 as the average cost. The cost of mechanical filtration depends largely on the amount and the cost of the coagulant used, and it is stated that plants can be operated at a cost of $2.00 per million gallons. The choice of one of the two systems depends on local conditions, with preference for the slow sand filtration for large cities and for highly polluted waters, and for the mechanical filtration for smaller towns and muddy supplies.

LEONARD P. KINNICUTT.

PATENTS.

NOVEMBER 4, 1902.

712,527. James B. Hannay, Loch Long, Scotland. **White pigment.** Lead sulphide ore is fused on hot coke slabs which burn the ore to a sulphate, the slabs acting as wicks so that oxidation and volatilization takes place mainly by the heat of the slabs generated in the formation of the basic sulphate in an atmosphere with excess of oxygen so that the products of combustion do not contain any reducing gases, the pigment being condensed and collected.

712,545. John A. Just, Syracuse, N. Y. **Preserving milk.** Small amounts of calcium oxide dissolved in a solution of calcium chloride, sodium calcium citrate and an alkaline hypochlorite are added to the milk, which is violently boiled on a surface heated to between 212° and 270° F., drawing the film on another surface similarly heated, and quickly removing the film.

712,562. George H. Maisch, Baltimore, Md. **Incandescent mantle.** Made of the oxides of thorium, cerium, beryllium, magnesium, and cobalt, combined with a glaze enamel of feldspar, flint, whiting, china clay and lead carbonate.

712,635. James F. Bartlett, Mayfair, Ill. **Waterproof fuel.** Coal dust 75, cow manure 25, blood and lime, 2 gallons each, alum 4 ounces, glue 2 pounds, water 4 gallons.

712,640. Anson G. Betts, Troy, N. Y. Treating **anode residues.** A part of the lead, copper, antimony and arsenic present in electrolytic residues is combined with chlorine and removed in solution, while the water, antimonious and arsenious chlorides are distilled off.

712,726. Albert Sauer, Warsaw, Russia. Assignor to Deutsche Continental Gas Gesellschaft, Dessau, Germany. **Prussian blue.** The iron sludge from illuminating gas purifiers is boiled to remove ammonia, then treated with sulphuric acid to render the iron compounds soluble, and filtered, which separates ammonium sulphate, and the residue is oxidized.

712,747. Arthur Weinders and Otto Lange, Frankfurt-on-Main, Germany. Assignors to Leopold Cassella Co., same place. **Sulphur dye.** Metatolylene diamine and sulphur are heated to 220° C., and the product heated with caustic alkalies or alkaline sulphides, making a yellow dye soluble in water, insoluble in concentrated sulphuric acid.

712,756. Henry Bernstein, Philadelphia, Pa. **Artificial silk.** The liquor obtained by boiling raw silk furnishes a natural gum which is combined with gelatine, formed into threads and treated with formaldehyde to render it insoluble.

712,758. John V. Brauch and Bernard Hemann, Belleville, Ill. **Coating for metals.** Crude turpentine 20, linseed oil and fish oil each 40 per cent.

712,798. Benno Homolka, Frankfurt-on-Main and Friedrich von Bolzano, Hochst-on-Main, Germany. Assignors to Meister Lucius und Bruning, Hochst-on-Main, Germany. **Indoxyl.** Sodium amide reacts at a high temperature on salts of methyl anthranilic acid in the presence of suitable diluents, whereby the amide hydrogen of the anthranilic acid is replaced by an acid radical.

712,799. Joseph Horak, Konigswinter, Germany. **Dinas blocks.** Sand and lime is molded at a high pressure hardened by a high temperature under fluid pressure, and then burned.

712,807. Victor Karavodine, Paris, France. **Subjecting mineral substances to heat and pressure.** Pulverulent substances like asbestos are mixed with sodium silicate insoluble in water but containing water in chemical combination, and the mass subjected to a temperature of 250° to 400° C. and a pressure of at least 100 kilos per square centimeter.

712,818. Heinrich Linnekogel, Stuttgart, Germany. **Absorptive wadding.** Fibers are saturated with an emulsion of water, maleïc acid and vaseline, wrung out and treated with a weak solution of a silver cyanide, dried and felted.

712,870. Charles H. Vickermann, Philadelphia, Pa. **White lead.** In the Dutch process, the lead is carbonated in the presence of fibers of the sumac which have been previously leached, and deprived of coloring.

712,891. Herman A. Abendroth, Berlin, Germany. **Ammonia still.** A form of coffee still, with movable covers on the inlet pipes.

712,925. Gustave Gin, Paris, France. Making **ferro-silicon, and silico-spiegel.** Silicon slags with silicon coating from Bessemer or Martin furnaces are pulverized and one molecule of carbon for each molecule of oxygen added to the charge of an electric furnace, whereby the silicates are reduced and metallic silicides formed.

712,995. Rufus N. Chamberlain, Depew, N. Y. Assignor to Gould Storage Battery Co., N. Y. **Peroxidizing battery plates.** Lead plates are made anodes in a bath of sulphuric acid to which nitrate of lead is added and after electrolysis the resulting sulphate of lead is removed.

713,020. Elmer A. Sperry, Cleveland, Ohio. Making **battery plates.** Spongy lead 65 per cent., lead oxide 30 per cent., and an alkaline salt 5 per cent., are mixed dry, and moistened with an alkaline hydroxide, then applied to the grid and compacted.

713,043. John Armstrong, London, England. **Refining volatile metals.** Zinc and similar ores containing less volatile metals are fluxed to slag, the more volatile metals, the fumes condensed and returned to the furnace, the slag drawn off and distilled with fuel to obtain the zinc, etc., and the lead, silver and similar metals tapped out.

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713,046. Otto P. Amend, New York, N. Y. **Tanning hides.** Treats hides with chromium nitrate in solution.

713,116. Chas. T. Lee, Boston, Mass. **Treating fiber.** Boils vegetable fiber in a solution of lime saccharate.

713,122-3. Amanda M. Lougee, Boston, Mass. **Electric conduits.** An insulating conduit of armor having on its inner surface layers of a rubber compound with asbestos and mica, and successively smaller percentages of vulcanizing ingredients, and vulcanizing the lining in place.

713,155. Wilson H. Rowley, St. Louis, Mo. **White lead.** The lead is atomized in an inverted air-tight chamber filled with moistened steam, discharging the particles at once into cold water, and when a mass is collected, draining and drying the same in free air.

713,190. Carl L. V. Zimmer, Hamburg, Germany. **Insulating compounds.** Bitumen is added to cottonseed oil, 1 part to 3, then alkali solution enough to saponify the glycerides, heat till saponification is complete then raise the temperature to 200° C. and introduce air enriched with oxygen.

713,277. Anson G. Betts, Lansingburg, N. Y. **Electrolytic refining lead.** The electrolyte contains in solution a fluorine compound of lead and gelatine, which restrains the crystallization of the electro-deposited lead.

713,297-8. William F. M. Goss, Lafayette, Ind. Assignor to United States Distillation Co., Indianapolis, Ind. **Apparatus and process of distilling.** A portion of liquid is evaporated and the vapor condensed by another portion of the same liquid, while the condensate is used for evaporating a third portion, the flow of vapors and of liquids being in opposite directions, whereby the greatest possible difference of temperature is constantly maintained between the vapors and the liquid, and the transfer of heat made most effective, the united vapors and condensates flowing from the hottest to the coldest vessel continuously.

713,309. John A. Just, Syracuse, N. Y. **Water paint.** Barium hydroxide 25, pulverized dry casein 75 parts, and mineral matter for color desired.

713,395. John Carstairs, Bradford, England. **Separating proteids from non-nitrogenous bodies.** The combined proteid and fat or oil is mixed with a solvent of 9 parts phenyl alcohol and

1 part benzyl alcohol dissolved in methyl alcohol, and the mixture is heated.

713,432. Eduard Hepp, Frankfurt-on-Main. Assignor to Farbwerke, vorm. Meister Lucius und Bruning, Hochst-on-Main, Germany. **Polyamino anthraquinone sulpho acids.** Acyl derivatives of polyamino-anthraquinone are treated with nitric acid, saponified, and the nitro amino anthraquinone thus obtained is heated with alkali sulphites. The alkali salts of these acids are soluble in water with a blue-violet color, becoming red by adding strong HCl, becoming nearly colorless with strong sulphuric acid of 66 Beaumé, while zinc dust and dilute alkalies give a red color, dyeing unmordanted wool in acid baths from blue-violet to pure blue.

713,437. Henry S. A. Holt, Ludwigshafen, Germany. Assignor to Badische Anilin und Soda Fabrik, same place. **Substituted indoxyl.** An aqueous solution of indoxyl is made acid by HCl, then treated with a halogen, and boiled with pyridine, which yields a halogen indigo.

713,447. Paul Julius and Fritz Guenther, Ludwigshafen, Germany. Assignors to Badische Anilin und Soda Fabrik, same place. **Diamino base for dyes.** Dinitro-dimethoxy-diphenylmethane is reduced; the product is soluble in chloroform, benzene and alcohol, but insoluble in water; it melts at about 107° C. and yields a tetrazo compound that combines with β-naphthol to form a red dye.

713,474. August H. Mies, Jr., Budesheim, and Albert Cobenzyl, Bingen, Germany. **Sensitizing material.** Impregnates fabric with soluble starch and dries, then heats to a temperature that will render the starch insoluble and sensitizes the coating.

713,475. John C. Mims, New Orleans, La. Assignor one-half to Quitman Kohnke, same place. **Refining asphalt oils.** A mixture of potassium bichromate (5 parts) and sulphuric acid (95 parts) is added to the material in the proportion of from 1 to 10 per cent., the mixture allowed to settle and washed with a 5 per cent., aqueous solution of sodium hydroxide, and 5 per cent. sodium carbonate, and then the oil is separated from the sediment.

713,507. Conrad Schraube and Walter Voigtlander-Tetzner, Ludwigshafen-on-Rhine, Germany. Assignors to Badische Anilin und Soda Fabrik, same place. Red **disazo** dye. Tetrazo diphenyl and salicylic acid are combined 1 molecule each, then 1-naphthol-3-6-disulpho acid is added, the product is soluble in water blue red, and on reduction with zinc dust and ammonia yields benzidine, *p*-amino salicylic acid 2-aminonaphthol-3,6-disulpho acid.

713,552. Winfield S. Brandt and Frank J. Root, Binghampton, N. Y. **Wood alcohol.** The readily condensible gases are condensed from the heated pyroligneous products, the remaining gases are mixed with steam, the mixture is scrubbed, and the acid freed by the action of the steam is recovered in a secondary condenser.

713,568. Henry H. Loyd, Germantown, Pa. Assignor to Electric Storage Battery Co., Philadelphia, Pa. **Non-active metal.** Lead cast with 12 per cent. antimony and rolled in a cold state.

713,580-1-2. Henry D. Winton, Wellesley Hills, Mass. Assignor one-half to Francis C. Hersey, same place. **Cereal food.** Cleans a granulated cereal, mixes with it a thin sugar syrup with rapid agitation, compresses into blocks and dries.

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713,602. Charles Charlopin, Paris, France. **Obtaining oxygen.** HCl and compressed air are forced into a mixing chamber and heated in the presence of copper chloride, reacting to form pure chlorine, steam and a copper salt, mixed with air and nitrogen; the mixture of gases is delivered to a condenser which condenses the steam and the water takes up the hydrogen chloride, the remaining gases being sucked off into a separator under a pressure of 8 to 10 atmospheres where the chlorine is liquefied and precipitated, the other gases escaping; the liquefied chlorine is evaporated in a mixing chamber containing superheated steam, producing pure HCl and O; and lastly washing the mixture whereby the HCl is dissolved and the oxygen delivered to the gas-holder in a pure state.

713,620. Lucien J. P. M. Y. Dupire, St. Pol, France. **Cattle food.** Washes vegetable matter in an alkaline solution to remove gummy and resinous matter and mixes it with 30 to 60 per cent. of molasses.

713,646. Hermann Kaserer, Vienna, Austria-Hungary. **Clearing acid fluids.** Adds, with stirring, a casein compound decomposed by acids, as alkali casein, and removes the precipitate.

713,710. Leo Stein and Wilhelm Storr, Berlin, Germany. **Joining glass or porcelain.** Mixes a flux with a good conductor of electricity, applies the mixture to the edges of the material to be united, heats to fusion and union, then applies a deposit of metal to the edges of the product with the conducting flux as a base. The flux may be borax, chalk, lead oxide, aluminum powder and water glass.

713,736. Albert C. Blossier, Paris, France. **Manufacturing rubber.** Mixes 80 parts zinc oxide, and 40 parts magnesium oxide and incorporates the mixture with 100 parts of softened pure rubber having 6 parts of litharge, molding and vulcanizing in a solvent with $2^1/_2$ per cent. sulphur protochloride.

713,802. Auguste J. Rossi, N. Y. Assignor one-half to James McNaughton Tahawus, N. Y. Process of combining **titanium with iron.** A mixture of titanic oxide, carbon and iron is adapted to make a pig, having from 2 to 5 per cent. of titanium; the mixture is heated to 3,500° F. then allowed to cool and melted again with sufficient iron to make the resulting pig have just the percentage desired, and which fuses at the temperature of melting iron, about.

713,837. Arthur Barraclough and Harry Barraclough, Halifax, England. Process of making **colored designs on textile goods.** Weaves the fabric with plain yarns, and yarns covered with vegetable fiber, the yarn being wool, then dyes, and afterward removes the covering by acids or otherwise.

713,840. Woodbridge H. Birchmore, Brooklyn, N. Y. Assignor one-half to Clarkson A. Collins, same place. **Preserving liquids.** Sterilizes the liquid to be preserved as milk, forces a sterile liquid into a vessel, displaces it by a sterile gas, then displaces the gas by the sterile milk under pressure.

713,846. William W. Brasington, Marietta, Ohio. **Paint.** Mixes cold refined coal tar 44, gasoline 5, and No. 10 rubber cement 1 part.

713,863. T. A. Edison, Lewellyn Park, N. J. **Coating phonograph records.** The record is put in an exhausted chamber near an electrode of the coating metal, a silent or brush discharge is produced between the electrode and another electrode on the opposite side of the record, whereby the record receives a metallic deposit, and then electroplating on said deposit, and finally removing the record from the metallic shell.

713,936. James H. Ashwell, Nottingham, England. **Glossing yarn.** Yarn is moistened, then steeped in caustic soda, then squeezed and treated with carbon disulphide at 90° to 120° F. dried, and boiled in a salt solution.

713,999. Frederich Lehner, Zurich, Switzerland. Assignor to Vereinigte Kunstseide Fabriken, Frankfurt-on-Main, Germany. **Artificial horsehair.** A thread of nitrocellulose is drawn through a bath of alcohol ether till the fiber is compacted, then drawing it through a hardening bath of water, then washing, drying and coating with caoutchouc or gelatine. Other kinds of artificial fiber may be used.

714,000. Otto Liebknecht and Benno Homolka, Frankfurt-on-Main, Germany. Assignors to Meister, Lucius und Bruning, Hochst-on-Main, Germany. Making **indoxyl.** Substances like sodium adapted to decompose water at ordinary temperatures are caused to react on aromatic compounds like phenyl glycin, its salts or esters.

714,039. Oscar Russell, Chicago, Ill. **Fire-proofing compound.** Sodium silicate 12, and ivory black 1 pound.

714,040. Thomas C. Sanderson, Chelsea, N. Y. Obtaining **antimony.** Melts a bath of iron sulphide, maintains a flame on it, adds the ore of antimony sulphide, also metallic iron to reduce it, and runs off metallic antimony continuously.

714,042. Bruno R. Seifert, Radebeul, Curt Philipp and Max. H. Gmeiner, Dresden, Germany. Assignors to Chemische Fabrik von Heyden, Radebeul, Germany. Making **indigo.** The dialkyl esters of phenyl-glycin ortho carboxylic acids are treated with nitrosifying agents, then with alkalies in the presence of reducing agents as sodium sulphide. Example, nitrosophenyl-glycin-*o*-carboxylic acid diethyl ester 251 parts, acetic acid 1000, sodium nitrite 70, water 200 parts all cooled to 0° C.

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714,139. George B. Brown, Reading, Pa. Assignor to Carpenter Steel Co., N. J. High **tungsten steel.** A new steel with from 1 to 3 per cent. chromium, and 15 to 30 per cent. of tungsten.

714,145. Lewis Cheeseman, Alexandria, Va. Assignor to Park Agnew, A. H. Agnew, and M. B. Harlow, same place. **Recovering acids from niter cake.** The cake is dissolved in water, the sulphuric acid precipitated with calcium oxide for land plaster, the iron is also precipitated with more calcium oxide, filtered and solution of barium sulphydrate added and recovered as barium paint.

714,160. Herbert H. Dow, Midland, Mich. Assignor to Dow Chemical Co., same place. **Extracting bromine.** Brine containing bromine is oxidized and blown with air to remove bromine and chlorine, and this air loaded with bromine and chlorine is treated with fresh brine whereby most of the chlorine is removed, then absorbing the remaining chlorine, oxidizing the brine recovered from the blowing-out process to excess, and treating the unoxidized brine with the chlorine and bromine thus obtained.

714,201. Stanislaw Laszcynski, Berlin, Germany. Assignor to Titus von Michalowski, same place. **Storage battery.** Negative electrode nickel oxide, positive electrode sponge zinc, and electrolyte potassium or sodium aluminates.

714,235. Joseph Poliakoff, Moscow, Russia. **Plastic compound.** Plaster of Paris and water are added to hot melted glue and the mixture boiled, then glycerin, wax and chrome alum are added.

714,277. Andre Blondel, Paris, France. **Composite carbon for arc lamps.** Composed of three concentric parts, the core of alkaline salts, a surrounding body of carbon mixed with alkaline earths as cerium, etc., and the whole coated with pure carbon.

714,330. Jacob Reese, Philadelphia, Pa. **Basic slag.** Mineral

tribasic calcareous phosphate is mixed with manganese oxide and iron oxide, and fused with an oxidizing flame till it flows, whereby the percentage of base is increased.

714,331. Jacob Reese, Philadelphia, Pa. **Calcic phosphate.** Basic open hearth slag and a mineral calcium phosphate, both low in silica are fused in the presence of an oxidizing flame, annealed and ground.

714,347. Arnold Wiens, Bitterfeld, Germany. Making **oxalates.** A mixture of formates, and oxalates is heated to from 360° to 410° C. See patent 659,733.

714,400. Maurice C. Rypinski, Schenectady, N. Y. Assignor to General Electric Co. **Electrolytic cell.** One electrode is aluminum, the other may be carbon and the electrolyte is a salt of an organic acid as Rochelle salts.

714,428. Ernest Wirth, Dortmund, Germany. **Reducing nitro compounds.** Nitro compounds containing two or more nitro groups are heated with alkali sulphides containing water to 110° C.

714,433. Otto P. Amend, New York, N. Y. **Tanning liquor.** Consists of a salt of a leather-forming metal and a soluble alkaline nitrite as chromium nitrite.

714,484. Heinrich von Hochstetter, Troppau, Austria-Hungary. **Acids of the fatty series.** A dry gaseous mineral acid as HCl is passed over a salt of a fatty acid like calcium acetate at a temperature above the boiling-point of the fatty acid.

714,502. Herman C. Meister, St. Louis, Mo. **Extracting zinc from zinc skimmings.** The skimmings are treated with the oxide of an alkali or alkaline earth in the presence of moisture to form zinc oxide, the soluble impurities being removed in water solution.

714,503. As above, with addition of heat, and carbonates of alkalies in place of oxides, whereby zinc carbonate is formed.

714,510. Richard G. Nash, Lucan, near Dublin, Ireland. **Aerating milk.** Heat skimmed milk to 160° F., cool to 40° F., sterilize the aerating gas by passing it through a heated coil in a closed chamber, then through a coil submerged in cold water, then the gas is sent through sterilized water containing a flavoring essence, the milk is charged with the sterilized gas and bottled, the bottles are heated for an hour in a closed vessel to 150° to 212° F., making a sterilized aerated beverage.

714,521. Christian Shallberger, Vancouver, Canada. **Preserving wood.** Fish oil 2, linseed oil 2, asphalt 6, kauri 1, tallow 4, rosin 8, Manila gum 1, coal tar 2, pitch 8, creosote 1, manganese oxide 2 parts.

714,541. Aaron M. Weber, New York, N. Y. **Whalebone substitute.** A plurality of piassava or bast fibers are coated with

soluble starch and formed into a flattened stiffening strip with a holder stitched on.

714,542. Arthur Weinberg and Otto Lange, Frankfurt-on-Main, Germany. Assignors to Leopold Cassella Co., same place. **Orange-brown sulphur dye.** Metatolylene diamine is heated with sulphur to 220° C., forming an insoluble product that is made soluble by heating it with alkalies. Soluble in water, orange-brown in the presence of alkaline sulphides, giving a brown precipitate with acids insoluble in concentrated H_2SO_4.

714,590. Charles C. Lockwood and Wm. C. Banks, New York, N. Y. **Depolarizer.** Finely divided iron particles are copper-plated and the plating oxidized thereon.

714,598-9. Sidney T. Muffly, Bowdry, Ga. Assignor to Runyon Pyatt, New York, N. Y. Apparatus and process for **separating metals from solutions.** A mattress cathode of cellular porous carbon plate and casings containing a filiform packing of lead and zinc composition, the whole inclosed in a fabric cover and with a plate anode of iron, and means for supplying air to the bottom of the receptacle and a source of electricity. The process of precipitating gold, etc., from solutions by heating the solution in connection with warm air currents, and passing it into an insulated enclosed electrolytic field between electrodes, preventing corrosive non-metallic precipitates from floating off, passing said solution through the filiform packing and adding free cyanide of potassium.

714,618. John Stevenson, Jr., Sharon, Pa. **Alloy.** Manganese 68, phosphorus 25, carbon 5, and impurities, including iron, 2 per cent.

714,647. Walter Perry, Ansonia, Conn. **Cement for castings.** Powdered iron 50 to 90, plaster of Paris 8 to 35, dextrine 2 to 15, ground glass 5 to 25, a salt of sodium or potassium 0.5 to 5 parts.

WM. H. SEAMAN.

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WILLIAM A. NOYES, Editor.

INORGANIC CHEMISTRY.

Comparison of the Radiations from Radioactive Substances. BY E. RUTHERFORD AND (MISS) H. T. BROOKS. *Phil. Mag.* [6], 4, 1–23 (see this Rev., 9, 1).—The radiations of uranium, thorium and radium were most closely studied. Radioactivity is shown to be a very complicated phenomenon. Uranium and radium, and probably also thorium, emit negatively charged particles, with high velocities, closely resembling cathode-rays. They all emit also rays non-deviable by a magnetic field. These rays can penetrate gases and thin layers of metals. The absorption of these rays by air or solids is approximately proportional to the density of the screen. The non-deviable rays differ from one another in penetrating power and consequently cannot be ascribed to any radioactive impurity common to all these substances. The decreasing order of power of penetration is: Thorium, radium, polonium, uranium. In addition, thorium and radium produce emanations which behave like radioactive gases. The emanations of thorium and radium differ greatly in their rates of decay, that of the latter being more persistent. At a red heat the emanation of thorium was increased three or four fold, while that of radium was increased 10,000 fold; neither recovered on cooling. The presence of an emanation gives rise to "excited" radioactivity. These non-deviable radiations have about the same penetrating power but decay at different rates.

H. N. McCOY.

Deviable Rays of Radioactive Substances. BY E. RUTHERFORD AND A. G. GRIER. *Phil. Mag.* [6], 4, 315–330.—The main object of the investigations was to obtain experimental evidence regarding any possible relationship between the non-deviable (α) radiations and deviable (β) radiations of uranium, thorium and radium. The electrometer method of measurement was used.

To measure the β-radiations the α-radiations were absorbed by thin metal screens which allowed the β-radiations to pass. These latter radiations were deflectable by a magnetic field. Emanations were excluded from the vicinity of the electrodes by means of a mica screen. The ratio of the intensity of the β- to α- radiation is 0.0074 for uranium and somewhat less for thorium and uranium. For very thin layers, the intensities of the β-radiations of powdered uranium and radium compounds are nearly proportional to the weight of the substance, but for a given surface and larger quantities of material, the effects tend to reach limiting values due to absorption of the radiations by the powders themselves. By chemical means, small, very active portions, ThX, and UX, were obtained. These gave chiefly β-radiations. The remaining larger, less active portions gave only α-radiations. This leads to the conclusion that α- and β-rays do not bear to one another a relationship similar to that between cathode and Röntgen rays. The authors believe that it is probable that most of the deviable (β) rays from uranium and thorium are given out by a secondary product produced by a disintegration of the atoms or molecules. These secondary products are thought to differ in chemical properties from uranium and thorium, and can be separated, constituting UX and ThX. H. N. McCoy.

The Existence of Hydrogen Tetroxide. By A. M. Clover. *Am. Chem. J.*, **29**, 463–474.—Bach has studied the action of a solution of potassium permanganate on a solution of K_2O_4 in dilute sulphuric acid and found the amount of oxygen evolved to be from 25 to 34 per cent. in excess of that calculated for the hydrogen peroxide present, as shown by the volume of permanganate used. He was led to conclude that the solution contained a considerable amount of hydrogen tetroxide, H_2O_4. These experiments have been repeated by the author, who finds no evidence of any peroxide other than H_2O_2. Titrations with permanganate in the presence of an excess, great or small, of sulphuric acid, gave the amount of oxygen calculated for H_2O_2. Pure hydrogen peroxide, with insufficient sulphuric acid, gives more oxygen than the permanganate used demands; on account of the catalytic action of the precipitated manganese dioxide. The author believes Bach's results due to the use of insufficient acid.

H. N. McCoy.

On Double and Triple Thiocyanates of Caesium, Cobalt, and Silver. By F. L. Shinn and H. L. Wells. *Am. Chem. J.*, **29**, 474–478.—The following salts were prepared and analyzed: $Cs_2Co(SCN)_4.2H_2O$, deep blue crystals; $CoAg(SCN)_3.2H_2O$, small, deep blue crystals; $Cs_2CoAg_2(SCN)_6.2H_2O$, bright pink, elongated plates. The color of the last salt, compared with the first two, strengthens the conclusion, reached in a previous article (*this Rev.*, **9**, 1) that the triple salts are not compounds of two double salts. H. N. McCoy.

MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

Description of Port Orford Quadrangle [Oregon]. By J. S. Diller.—This descriptive text, accompanying the *Port Orford Folio No. 89 of the Geological Atlas of the United States*, issued by the Geological Survey, contains hitherto unpublished descriptions of the geology of the quadrangle and thirteen analyses by the reviewer of serpentines, gabbros, basalts, and porphyries, the four groups in which the rocks of the region are considered. "The serpentine is distinct from the gabbro, but the gabbro and basalt are closely related, being apparently different grades in the crystallization of one magma, and the dacite-porphyry in places also has relations to the gabbro, although it is in the main distinct." There are also analyses of two coals from the Eckley region, of one from Shasta Costa Creek, and two from Riverton, Coos County. Those from Eckley and Shasta Costa are very high in sulphur (up to 6.78 per cent.) which, in this maximum case at least, is almost wholly in organic combination. The occurrence of platinum in the placers of the region is discussed, but no definite indication is furnished as to its sources.

W. F. Hillebrand.

Maryland Geological Survey, Cecil County. 322 pp., maps, plates. **Maryland Geological Survey, Garrett County.** 340 pp., maps, plates.—These are the second and third of a series of reports on county resources in the state of Maryland. They contain chapters on the physiography, geology, mineral resources, soils, climate, hydrography, magnetic declination, and forests of the respective counties. Chemical analyses of clays and limestones appear in the Garrett County report, and of a few clays in that on Cecil County, and in both are mechanical analyses of soils. In the chapter on the geology of Cecil County, by Miss F. Bascom, are numerous analyses, mainly from the laboratory of the U. S. Geological Survey. A few of these are new, but most are taken from the paper by Leonard, "The Basic Rocks of Northeastern Maryland" (this Journal **24**, R, 121).

W. F. Hillebrand.

The Tin Deposits of the Malay Peninsula with Special Reference to Those of the Kinta District. By R. F. Penrose, Jr. *J. Geol.*, **11**, 135–154; map, plates, figures.—The greater portion of the tin is found on the western slope of the peninsula in alluvium derived from the decay of granitic rocks. This original source is made clear by the fact that the undecomposed granites making up with limestone the backbone of the peninsula, carry it also in association with the same minerals that are its companions in the alluvium. It is also rarely found in the limestone, but probably not as an original constituent. In 1901 the Malay peninsula furnished 47,000 tons of tin, over half the world's production.

W. F. Hillebrand.

Reed City Meteorite. BY H. L. PRESTON. *J. Geol.*, **11**, 230–233; 2 figures.—This octahedral siderite, weighing 19.8 kilograms before cutting, was found in 1895 near Reed City, Michigan. A feature of it is the ease with which the very prominent etch-figures may be made to appear, even polishing of a cut surface sufficing to bring out a faint outline. The rounded nodules of troilite, so characteristic of iron meteorites, were not observed on the sections made. Analysis by J. E. Whitfield gave: Fe, 89,386; Ni, 8.180. Spec. grav., 7.6. W. F. HILLEBRAND.

The Andover Meteorite. BY HENRY A. WARD. *Am. J. Sci.*, **15**, 395–396; 1 figure.—This communication formed part of a composite paper in the Proceedings of the Rochester Acad. Sci., in which several meteorites were described and which has already been noticed in this Review, present volume, p. 9.
W. F. HILLEBRAND.

A Pseudo-Serpentine from Stevens County, Washington. BY F. W. CLARKE. *Am. J. Sci.*, **15**, 397–398.—A rock having all the outward appearance of sepentine but the following composition as ascertained by Geo. Steiger: SiO_2, 13.08; Al_2O_3, 1.63; Fe_2O_3, 1.25; FeO, 0.19; MgO, 56.44; CaO, 0.33; H_2O at 100° C., 0.85; H_2O above 100° C., 23.94; CO_2, 2.03. Microscopical examimation reveals the presence of several minerals, which are probably hydromagnesite (5 per cent.), chlorite (14 per cent.), serpentine (20 per cent.), brucite (60 per cent.). The rock is from the quarry of the United States Marble Company, twelve miles north and west from Valley, a station on the Spokane and Northern Railroad. W. F. HILLEBRAND.

The Granite Area of Barre, Vermont. BY GEO. I. FINLAY. *Report of the Vermont State Geologist, 1901–1902*, pp. 46–59; map and plates.—This celebrated granite is described, and the darker variety from the area south of Millstone Hill was found to have the following composition, the rarer elements not having been determined: SiO_2, 69.89; Al_2O_3, 15.08; Fe_2O_3, 1.04; FeO, 1.46; MgO, 0.66; CaO, 2.07; Na_2O, 4.73; K_2O, 4.29; H_2O at 110°, 0.31; H_2O by ignition, 0.23; P_2O_5, trace. Total, 99.76.
W. F. HILLEBRAND.

The Terranes of Orange County, Vermont. BY C. H. RICHARDSON. *Report of the Vermont State Geologist, 1901-1902*, pp. 62–101; maps and plates.—The chemistry of this report relates chiefly to the Washington marble, the specimen analyzed having been taken from the quarry of Huntington and Clough, and is of such an extraordinary character as to invite rather detailed consideration.

The analysis first appeared in Vol. 47 of the Proc. Am. Assoc. Adv. Sci., p. 295 (Boston meeting, 1898), in such a form as to excite no particular comment except with reference to the note-

worthy percentages of glucina and lithia. In the present report greater details are afforded. Duplicate analyses are given of the soluble and insoluble portions into which the marble was divided, and the results of these separate analyses are also given combined as follows:

	(*a*).	(*b*).		(*a*).	(*b*).
SiO_2....	35.748	35.748	Na_2O....	0.186	0.187
TiO_2 ...	0.190	0.189	K_2O.....	0.063	0.064
CO_2....	22.860	22.870	Li_2O	0.823	0.824
Fe_2O_3 ..	0.010	0.010	H_2O.....	0.108	0.107
Al_2O_3 ..	6.113	6.112	P_2O_5	1.359	1.359
FeO ...	0.940	0.941	Cl	0.307	0.307
GlO....	0.313	0.315	F	0.026	0.026
MnO...	0.076	0.075	C	microscopical trace.	
BaO....	0.210	0.210		99.885	99.892
CaO ...	27.305	27.304	Less O = F and Cl	0.079	0.079
MgO...	3.248	3.244		99.806	99.813

It will be observed that the percentages are carried out to the third decimal and that in only one instance do the duplicate analyses show a difference in the second decimal for any one constituent. In only one other instance is the difference as much as four points in the third decimal. It would be interesting to know what methods led to such results, especially in the cases of glucina and lithia. Other analyses are given: Of arsenopyrite from East Braintree, of olivine in limburgite from Corinth, of "hexagonal crystals of phyllite" from the Washington limestone, of rhodonite from Wait's River, and of magnetite from Bethel. In most cases these analyses are also in duplicate and show the same astonishing agreement above observed.

To return to the limestone, the author is greatly surprised at "the presence of so many unexpected elements and compounds," and further remarks "Its complexity is so great that a single formula cannot well represent its chemical composition." Again, "Chlorine is probably present in combination with one of the alkali metals," yet the analytical details show that while the chlorine is wholly in the soluble portion, the alkalies are entirely confined to the insoluble part. A possible connection between the chlorine and the phosphoric oxide in the mineral apatite does not seem to have suggested itself, although the phosphoric oxide was also found wholly in the soluble part. Nor is it suspected that the necessary halogen of the apatite may have been in part fluorine, in which case this element must also have been found in solution, and not alone in the insoluble part as reported. The large amount of silica in the marble is unhesitatingly ascribed to two causes, the second of which is "the interjection of silicic anhydride in gaseous form prior to the metamorphosing of the marble."

Other points might be touched upon, but the above will enable chemists to draw their own conclusions. Seriously, it is a great misfortune that work of this character should find its way into

the pages of a report, which, by virtue of its official stamp, will be accepted by most of its readers as containing only authoritative information. W. F. HILLEBRAND.

Contributions to Economic Geology. BY S. F. EMMONS AND C. W. HAYES, Geologists in charge. *U. S. Geol. Survey Bull. No. 213*, pp. 449.—From this bulletin, containing 61 contributions from 33 members of the survey, all questions of purely scientific interest have been excluded. "It is designed to meet the wants of the busy man" and "affords a better idea of the work the survey as an organization is carrying on for the advancement of the mining interests throughout the country than can be readily obtained from the more voluminous reports." If it meets with a favorable reception a similar bulletin may be issued yearly.

The papers represent three classes: (1) Preliminary discussions of the results of extended economic investigations which will later be published by the survey in more detailed form; (2) comparatively detailed descriptions of occurrences of economic interest—but not of sufficient importance to necessitate a later and more extended description; (3) abstracts of certain economic papers which have appeared in survey publications during the last year, chiefly such as give a general account of the distribution and mode of occurrence of particular mineral deposits throughout the United States."

It is impossible to take note of all the papers, much less to attempt abstracts of their contents, but the titles of those which appear to contain matter that may interest the chemist, either new or hitherto unnoticed in this Review, are given in the following list:

Progress Report on the Park City Mining District, Utah; J. M. BOUTWELL, p. 31. *Placer Gold Mining in Alaska in 1902*; A. H. BROOKS, p. 41. *Gold and Pyrite Deposits of the Dahlonega District, Georgia*; E. C. ECKEL, p. 57. Contains an average analysis of Chestatee pyrite. *Mineral Deposits of the Bitterroot Range and Clearwater Mountains, Montana*; W. LINDGREN, p. 66. *Ore Deposits in Tonopah and Neighboring Districts, Nevada*; J. E. SPURR, p. 81. *Ore Deposits of Bingham, Utah*; J. M. BOUTWELL, p. 105. *Copper Deposits of the Redding Region, California*; J. S. DILLER, p. 123. Contains analyses of meta-rhyolite and meta-basalt from the Bully Hill district. *Copper Deposits at Clifton, Arizona*; W. LINDGREN, p. 133. *Copper Deposits of Bisbee, Arizona*; F. L. RANSOME, p. 149. *Ore Deposits at Butte, Montana*; W. H. WEED, p. 170. *Zinc and Lead Deposits of Northern Arkansas*; G. I. ADAMS, p. 187. *Lead and Zinc Deposits of the Joplin District, Missouri–Kansas*; W. S. TANGIER SMITH, p. 197. *Lead, Zinc, and Flourspar Deposits of Western Kentucky*; E. O. ULRICH AND W. S. T. SMITH, p. 205. *Zinc and Manganese Deposits of Franklin Furnace, New Jersey*; J. E. WOLFF, p. 214. *Utilization of*

Iron and Steel Slags; E. C. ECKEL, p. 221. Contains many analyses. *Iron Ores of the Cartersville District, Georgia*; C. W. HAYES AND E. C. ECKEL, p. 233. *Manganese Deposits of Santiago, Cuba*; A. C. SPENCER, p. 251. *Coal Resources of the Yukon Basin*; A. C. Collier, p. 276. *Salt and Gypsum Deposits of Southwestern Virginia*; E. C. ECKEL, p. 406. Numerous analyses from various sources. *Occurrence and Development of Ocher Deposits in the Cartersville District, Georgia*; C. W. HAYES AND E. C. ECKEL, p. 427. Contains analyses of natural ochers. *Talc Deposits of North Carolina*; ARTHUR KEITH, p. 433.

W. F. HILLEBRAND.

Note on Titaniferous Pyroxene. BY ALEXANDER N. WINCHELL. *Am. Geologist*, 31, 309–310.—A pyroxene from Pigeon Point, Minnesota, with 4.39 per cent. TiO_2 was some years ago described by the author under the name pigeonite, its chief characteristic being the variable but always low optic angle. From a recent analysis by G. Becker of a titaniferous pyroxene from Kilimanjaro, with normal optic angle, it seems that the deviation in pigeonite cannot be ascribed to titanium.

W. F. HILLEBRAND.

Klamath Mountain Section, California. BY J. S. DILLER. *Am. J. Sci.*, 15, 342–362.—This paper deals almost wholly with the sedimentary formations of the Klamath mountains, but there are two analyses by E. T. Allen of tuff, one from Rice's quarry, six miles southeast of Paskenta, representing the tuff of the Sacremento Valley, the other from the Redding Creek basin.

W. F. HILLEBRAND.

On the Composition of Some Canadian Amphiboles. BY B. J. HARRINGTON. *Am. J. Sci.*, 15, 392–394.—A reddish brown, unusually transparent amphibole from Grenville in Quebec is characterized by a high percentage of fluorine (2.80 and 2.93 observed). It had been mistaken for garnet in spite of its normal cleavage and optical properties. Specific gravity 3.11; hardness 6 or a little over. Analyses are also given of two other amphiboles from the essexite of Montreal and of Mount Johnson, respectively. Both are highly titaniferous (4.53 and 5.04 per cent.). The former has a hardness between 5 and 6 and a specific gravity of 3.159.

W. F. HILLEBRAND.

Minerals from Leona Heights, Alameda County, California. BY WALDEMAR T. SCHALLER. *Univ. of California, Bull. Dept. Geol., Vol. 3, No. 7*, pp. 191–217; plate.—By the oxidation of pyrite containing some chalcopyrite in the Alma mine, numerous soluble sulphates have been formed, of most of which the author has made analyses and determined the optical constants. Those analyzed are: Melanterite, pisanite, chalcanthite, copiapite, ep-

somite, and a new copper sulphate, isomorphous with melanterite and epsomite, and named *boothite*. All of the above hydrous sulphates are regarded as salts of tetra-hydroxyl sulphuric acid with six molecules of water of crystallization. Ten new crystal forms are established for pisanite, seven for melanterite, and two for chalcanthite. W. F. HILLEBRAND.

Boothite, a New Sulphate of Copper. See preceding abstract.
W. F. HILLEBRAND.

Palacheite. BY ARTHUR S. EAKLE. *Univ. of California, Bull. Dept. Geol., Vol. 3, No. 9*, pp. 231–236; plate.—This mineral, a hydrous basic sulphate of ferric iron and magnesium, named after Dr. Charles Palache, of Harvard University, occurs in bright red crystals in the Redington mercury mine at Knoxville, California. "The specimens are loosely coherent aggregates of minute crystals, which readily crumble on the slightest pressure." The crystal system is monoclinic, the single habit showing short prisms terminated by the basal planes in such development as to present the appearance of rhombohedrons. The axial ratio is a : b : c = 0.6554 : 1 : 0.3996, with β 117° 9′. "The crystals are transparent, and have a deep brick-red color, vitreous luster and a pale yellow streak. They are very brittle, have a hardness of 1.5 to 2, and a specific gravity of 2.075, determined with the Thoulet solution. Cleavage is very perfect parallel to the clino-pinacoid 010 and distinct parallel to the unit prism 110." Before the blowpipe, the mineral exfoliates and is converted into a brownish black, magnetic mass. In the closed tube much water is given off and by careful heating all can be expelled before the sulphate begins to break up. Cold water dissolves slightly and the solution when heated deposits a bulky, yellowish red precipitate. Acids dissolve the mineral easily. It is tasteless. The composition is: Fe_2O_3, 19.51; MgO, 9.35; SO_3, 38.37; H_2O at 100°, 19.53; H_2O above 100°, 12.75; total, 99.51; and the formula deduced is $Fe_2O_3.2MgO.4SO_3.15H_2O$. The mineral is supposed to be distinct from the rubrite of Darapsky (*N. Jahrb. Min.*, 1890, 1, 65). W. F. HILLEBRAND.

A Preliminary Report on a Part of the Granites and Gneisses of Georgia. BY THOMAS L. WATSON. *Geol. Survey of Georgia, Bull. No. 9A*, 367 pages; maps and plates.—This elaborate study covers the above-named rocks of but a portion of the state—the principal granite-producing counties in Piedmont, Georgia. Chapter I treats of granites in general, their properties, varieties, ages, occurrences, history, uses, and their distribution in the United States, particularly in the Atlantic-Border region. Chapter II treats of the physical, chemical, and economic properties of building stones, more especially of granitic rocks used as such. In Chapter III the general geology and physiography of the re-

gion under study is described. "Chapter IV includes the general study of the chemic and lithologic characteristics and the correlation of the Georgia granitic rocks." The general principles of rock-weathering are discussed in Chapter V, and in the concluding Chapter VI are grouped tables of statistics, physical tests, and analyses by the author, the last giving the more important constituents without differentiation of the oxides of iron. For brief statements of many of the points brought out and elaborated in the discussions, the reader is referred to abstracts, in this journal, of preliminary papers by the same author that have appeared within the past two years (this Journal, **23**, R 129, **24**, R 120, 123, 342, 385). W. F. HILLEBRAND.

ANALYTICAL CHEMISTRY.

Report on a Cooperative Chemical Analysis of a Copper Slag. BY THORN SMITH. *Eng. Min. J.*, 75, 295–297.—The wide differences in the results obtained by twenty-three analysts on a sample of copper slag are accounted for as follows:

Silica.—Low results are due to the fact that a second evaporation of the filtrate was not made. High results indicate that the silica should be examined for impurities or that heating during ignition was insufficient.

Iron.—The errors in the determination of the iron are due to the lack of an accurate standard substance for determining the strength of the permanganate or dichromate solutions.

Alumina.—The low results were nearly all obtained by the phosphate method. The high results, usually obtained by difference, were due to silica either from the original substance or from the glassware.

Lime.—High results were due to insufficient washing before titrating with permanganate. Low results are caused by too much washing with hot water or by filtration before precipitation is complete.

Magnesia.—High results are due to insufficient washing, the presence of silica or to too low temperature during ignition. Low results are due to incomplete precipitation or to too little ammonia in the solution.

Zinc.—The "Low method" for zinc is not to be recommended in the presence of manganese and much iron. A majority of the analysts used the ferrocyanide method and the chief source of error was probably in standardizing the ferrocyanide solution.

Manganese.—"Volhard's method" was generally used. Analysts are advised to examine the zinc oxide and sodium carbonate for manganese.

Copper.—The cyanide and iodide methods give varying results on account of incomplete precipitation on the zinc or aluminum, and oxidation and solution during the washing. Weighing as

oxide may give high results through the introduction of other bases.

Sulphur.—Oxidation with nitric acid and potassium chlorate followed by precipitation as barium sulphate gave fairly satisfactory results. B. S. CUSHMAN.

Smoke and the Determination of its Density. BY A. A. CARY. *Elect. World and Eng.*, 41, 752.—In making smoke density-determinations, observations of the condition of the smoke should be made at frequent and equal intervals as, for instance, every half-minute. The observations are best made by the use of a smoke chart consisting of five rectangles printed in different shades, namely, light gray, darker gray, very dark gray, light black, and intense black. When the test is important, not less than two separated observers should make their records, noting time and number expressing the shade of smoke existing at the time, and these records should be compared. Besides these observations some one in the boiler room should note the time of each firing and cleaning, and also state the conditions existing at other recorded times, as "forcing the boiler," "running light," etc. If furnace gas analyses are made during these observations, and all of these results are compared on cross-section paper, a careful analysis of existing conditions pertaining to the production of smoke in the plant under consideration may be made, and a means for further suppressing the smoke can generally be found by making the proper deductions. It is convenient to use a time-keeping apparatus in making the smoke observations. A machine which has been used consists of a cylinder around which is a paper for the record, and which is turned by clock-work. A given distance around its circumference represents one minute. The pencil, pressing against this paper on the drum is moved across the face of the cylinder (parallel to its axis) by the observer, who pulls the slide rod carrying the pencil to its extreme left position when there is "no smoke." When the pencil is not moved, the revolving of the drum causes it to draw a line around the drum. For "slight smoke" the observer pulls the pencil over one division to the right, for "medium smoke" another, another for "black smoke," and again another for "very dense smoke." This gives the observations plotted, the ordinates representing time, and the abscissae degrees of smoke. One improvement by the author makes more accurate and convenient the movement of the pencil by the operator, and another decreases the size of the recorder and permits of using a long roll of cross-section paper. BENTON DALES.

The Use of the Zinc Reductor in the Estimation of Vanadic Acid. BY F. A. GOOCH AND R. D. GILBERT. *Amer. J. Sci.* (4), 15, 389–392.—The reduction of vanadic acid by zinc and acid yields an irregular product approximating the dioxide in

composition. To convert this into the more stable tetroxide before the titration with permanganate, the authors tried subjecting it to the action of air at various temperatures and for various lengths of time. Their titrations are made, after heating to 80°, with nearly twentieth-normal potassium permanganate solution, standardized by reference to twentieth-normal arsenious oxide. Blank experiments show that a correction of 0.2 cc. of permanganate solution has to be subtracted, because the " reading color " does not develop in the acid solution until this amount has been added. Their figures show that, although the oxidation by air appears to proceed rapidly at first, the complete conversion of the lower oxides to tetroxide by such action takes place with too great slowness and uncertainty to form the basis of a reliable and rapid quantitative method. The authors find then that silver oxide and silver salts, especially silver sulphate, will cause this oxidation, and not oxidize the tetroxide to pentoxide. In these experiments the flask which is to receive the solution from the reductor is charged with a saturated solution of silver sulphate in varying amounts. When the reduced solution from the reductor meets the silver sulphate a muddy deposition of finely divided silver begins, but upon boiling the mixture, the silver collects into a single spongy mass, which has to be filtered out only because of the action of the permanganate upon it. The solution is heated again to the boiling-point and titrated with twentieth-normal permanganate. For the smaller amounts of vanadium (0.0767 gram V_2O_5) the error in the given results varies from 0.13 per cent. to 0.65 per cent. For a larger amount (0.1918 gram V_2O_5) the errors in two determinations given are 0.78 per cent. and 1.25 per cent. The wider variations in these two are probably due, according to the authors, to the difficulty of catching the pink end reaction in presence of the reddish yellow color which appears as the vanadic acid is formed in considerable amount. But this is a difficulty inherent in the permanganate process of titration when large amounts of V_2O_5 are involved.

BENTON DALES.

The Use of a Rotating Cathode in the Electrolytic Determination of the Metals. BY F. A. GOOCH AND H. E. MEDWAY. *Amer. J. Sci.* [4], 15, 320–323.—The cathode consists simply of a 20 cc. platinum crucible which can be rotated 600 to 800 times per minute. It is held by means of a rubber stopper on the end of the vertically placed shaft of a small electric motor. Connection between the crucible and the shaft is secured by soldering a narrow strip of platinum to the shaft and bending it upwards along the outside of the stopper. The shaft is made in two parts. The electrolyses are conducted in glass beakers with platinum plate anodes. The negative pole of the battery used as the source of the current is connected with the bearing in which the shaft

rotates, and the positive pole with the platinum plate. A series of electrolyses of a solution of copper sulphate acidulated with dilute sulphuric acid is given, in which the current varies from 2.7 to 13.3 amperes per square decimeter, the time from ten to twenty-five minutes, and the error from 0.0 to nearly 0.5 per cent. in one determination (0.0003 gram in 0.0651 gram taken). Other series, equally as good, are given showing the results of the electrolysis of proper silver and nickel salt solutions and differently acidulated, copper salt solutions. Other metals are said to behave similarly. The deposits are sufficiently coherent and compact to permit accurate manipulation and weighing. The advantages of the process are the rapidity with which it can be carried out, its exactness and its simplicity. BENTON DALES.

Photometer Attachment. *Elect. World and Eng.*, **41**, 670.—This is a simple angulating device, designed by the Shelby Electric Company, which fits into the socket of any standard photometer. It enables one to turn the lamp so as to determine not only the horizontal candle-power, but to measure the light from any desired angle. Most disinterested authorities strongly favor the determination of the real value of an incandescent lamp by obtaining its spherical candle-power and considering this with the actual current required to operate it, in preference to measuring the lamp in the arbitrary manner generally used at present, namely, for its horizontal intensity. The principal argument against rating lamps by their spherical candle-power has been that there was no instrument by which such measurements could be taken at one reading that was not extremely complicated, and therefore not adapted to commercial use. Illumination is divided into two classes, general and local. The value of a lamp for general illumination can only be determined by considering the light emitted in all directions, while by far the greater part of the light used in local illumination is delivered through the end of the lamp opposite the base or within 45° therefrom. Hence it is unfair to rate the lamp solely by the light delivered horizontally.

BENTON DALES.

The Simmance-Abady Photometer. *Amer. Gas Light J.*, **78**, 530.—If the rays from two sources of light, one being, for example, red, the other green, are allowed to fall in rapid succession upon a screen or directly upon the retina, the eye ceases to distinguish the colors and is sensible only to the degree of intensity of the illumination. In this photometer, beams from each source of light are directed on a paper screen, across which vibrates a shutter, cutting off each ray in turn. If the lights are unequal in power the oscillation of the shutter at a given speed produces a vibrating effect, but on moving the screen and shutter nearer the weaker light, a point is reached where the rays from the two sources are equal, this being indicated on the screen by a total

absence of vibration. The introduction of this practical form of photometer has enabled very accurate determinations to be made of the actual power of electric arc lamps and of the Welsbach light. The delicacy and accuracy of the readings of this instrument are shown by the facts that when lights of the same color are tested by it, the results agree exactly with those obtained with the Bunsen or the Lummer-Brodhun apparatus; and that when the lights vary in color, different operators, although they disagree totally in their readings with these instruments, obtain results that coincide very closely when the same lights are tried with the Simmance-Abady instrument. BENTON DALES.

Modification of Nessler's Tube. BY HERBERT J. WATSON. *Am. Journ. Pharm.*, 75, 166.—The jar (which is illustrated in a cut accompanying the original article) is 12 inches in length, 3/4 inch in diameter, 9 inches from base to top mark (50 cc.) and graduated in 5 cc. with dashes for the 1 cc. graduations. A small tube projects from the side at the base, which may be plain or have a stop-cock. A number of plain tubes (50 cc. graduation) are necessary to collect the distilled ammonia. The method consists in connecting the side tube with a burette by a small rubber tube. The three tubes, each of free and of albuminoid ammonia, are nesslerized and mixed together. One of these tubes is placed beside the one connected with the burette containing the standard ammonia solution and moved with a vertical movement. The liquid in the standard column is made to increase or decrease at will and the number of cubic centimeters is always visible.

The jars with the side neck cost $1.75, and with stop-cock, $2.50. J. O. SCHLOTTERBECK.

METALLURGICAL CHEMISTRY.

Newfoundland Mining in 1902. *Eng. Min. J.*, February 14, 1903.—Figures furnished by J. P. Hawley, head of the department of mines, show 728,721 tons of iron ore mined, valued at $1 per ton; 71,482 tons of copper ore, valued at $3.50 per ton, and 26,000 tons of pyrites, valued at $4.50 per ton. Half the iron ore was worked at Sydney, Nova Scotia. Deposits of manganese ore covering a large area, and assaying from 35 to 41 $^{1}/_{2}$ per cent. manganese, exist in Conception Bay. J. W. RICHARDS.

The Concentration of Ores by Oil. BY W. MCDERMOTT. *Eng. Min. J.*, February 14 and 21, 1903.—F. E. Elmore has developed a practical and economical method of utilizing the remarkable power of some oils to absorb certain minerals and metals. It is entirely a surface action as between the oil and the wet particles of mineral, and the result is that the particles enter into the body of the oil. The essential points are (1) the nature

of the oil used, (2) the method of its application, (3) the separation of absorbed mineral from the oil. (1) Oil of the character of the thick residuum of petroleum distillation gives results far more effective than any other material, and is, in addition, cheap, free from mechanical loss when finely divided, and capable of supporting a relatively heavy charge of mineral without sinking in water. The degree of viscosity is important, and can be regulated by adding thinning or thickening oils or wax; in some cases the oil is stimulated by adding a small amount of acid. (2) Thick oil may be applied to a thin pulp. A slowly revolving cylinder with a helical launder within, fitted with low baffle-plates at intervals, gives sufficient agitation, without breaking up the oil unnecessarily. After mixing, it is run into a pointed box, from the bottom of which the rock and water flow, while the oil and mineral float on top and overflow. (3) The separation of oil from mineral is done by passing the mixture through a heater into a 48-in. centrifugal pan, having an inwardly projecting flange on top. Water is first run in, forming a wall the depth of the flange. The heated oil flows to the bottom of the pan, which runs at 1000 revolutions per minute, and passing up in a thin layer over the wall of water discharges over the flange at the top. During this passage, the mineral falls through the water and packs against the side of the pan. The separation is very perfect. A 100-ton plant is in operation at Sygun, Wales, and mechanical details for the apparatus necessary to run the process are given. The loss of oil is 1 to 2 gallons per ton of ore treated. The process is considered applicable to treatment of float and slimes; as a substitute for water concentration; concentration of minerals from heavy gangue, such as magnetite, heavy spar, garnet; separation of two valuable constituents in the same mineral, such as argentiferous sulphides from the tin-stone; diminution of slimes; removal of cyanide-consuming minerals from gold ores, before the application of cyanide. In general, the oil acts only on native metals, sulphides, antimonides, arsenides and tellurides, and not on oxides, carbonates, silicates or sulphates. With zinc blendes, the extraction is greater the higher the luster; cinnabar is easily saved; molybdenite is acted on very quickly. The process is not yet in operation in the United States.

J. W. RICHARDS.

Pig Iron Production in 1902. From *Bull. Am. Iron and Steel Assoc.*, *Eng. Min. J.*, February 7, 1903.—Additional details regarding the nature of the 17,821,307 tons produced in the United States are, that 16,315,897 tons (91.55 per cent.) was produced with coke and bituminous coal, 1,115,247 tons (6.26 per cent.) with coke and anthracite, 378,504 tons (2.12 per cent.) with charcoal, and 11,665 tons (0.07 per cent.) with coke and charcoal. Pennsylvania, Ohio, Illinois, and Alabama are the largest pro-

ducers, in the order named. There were 307 furnaces in blast on December 31, 1902. J. W. RICHARDS.

Briquetting Iron Ore Dust. BY H. S. MOULD. *Iron and Machinery World*, February 21, 1903. (Paper read before Eng. Soc. of W. Pa.).—In a blast-furnace producing 600 tons of iron per day, there is used approximately 1,085 tons of ore. If 80 per cent. of this is Mesaba ore, which loses about 8 per cent. of its weight in flue dust, there is 70 tons of ore blown out as dust per day, and at $3.50 per ton, its cost in Pittsburg, this represents a loss of $245 daily. This is not the only loss; the dust fluxes the stoves and wears the boiler flues. Clogging and slips in the furnace are also caused by the large proportion of fines. The average amount of moisture in Mesaba ores is 10.57 per cent., on which altogether some $1,202,231 a year is paid in freight, in bringing it to Pittsburg. If the ore were dried and briquetted at the mines, the freight on water, the loss of ore in the furnace, and all the other disadvantages, would be avoided. The question of briquetting economically has been satisfactorily solved, and it remains now for the iron makers to take it up as fast as possible. J. W. RICHARDS.

Nickel-Steel Rails. *Iron Age*, February 5, 1903.—The Pennsylvania Railroad has been so well satisfied with the test of 250 tons of nickel-steel rails placed on the famous horse-shoe curve, that 9,000 tons more have been ordered from the Carnegie company. The steel is soft Bessemer, with 3.25 to 3.50 per cent. of nickel. Their life is 3 to 4 times that of ordinary rails, their cost about double, but their value as scrap is also double that of the ordinary rails, so that the saving is 30 to 50 per cent. in cost, and, in addition, the cost of relaying 2 or 3 new rails.

J. W. RICHARDS.

Manganese Mining in Cuba. BY A. E. HEIGHWAY. *Eng. Min. J.*, February 14, 1903.—The Ponupo mine, twenty-two miles from Santiago, is the most important in Cuba, turning out last year 33,000 tons of 49 per cent. ore. The principal deposit is a dome-shaped hill 80 acres in extent, with ore distributed throughout it in beds, blankets or pockets, with an over-burden of 10 to 15 feet. The ore varies from nearly pure pyrolusite to mixtures of rock and dirt. It is separated by log-washers; the tailings run 15 to 30 per cent. manganese. 150 to 225 men are employed; wages, 85 cents per day. J. W. RICHARDS.

El Cobre Copper Mines, Santiago de Cuba. BY A. E. HEIGHWAY. *Eng. Min. J.*, February 17, 1903.—These mines produced $48,000,000 worth of copper ore in the eighteen years, from 1851 to 1869, but have been since then abandoned. A new company, with $800,000 capital is now pumping them out. Boilers and pumps of large capacity are taking out 5,000 gallons per minute, which is passed over a "California," that is, a series of broad

shelves one above the other, with an aggregate area of 200,000 square feet, where the mine water runs over scrap iron. About $5,000 per month is being recovered from the copper thus precipitated. There are 17 miles of underground workings, and many rich lodes are known to exist, so that it is believed that there is a prosperous future for these mines. J. W. RICHARDS.

Copper Bessemerizing Patent Invalid. *Iron Age*, February 5, 1903.—Judge Knowles decided in the United States Court, at Helena, Montana, on January 31st, that the Manhes patent for Bessemerizing copper matte was invalid, and, therefore, that copper companies using the Bessemer process are not obligated to pay license for the same. If the patent had been sustained, the damages for infringement would have amounted to some $2,000,000.
J. W. RICHARDS.

The Manhes Converter Patent. *Eng. Min. J.*, February 14, 1903.—The United Verde Copper Company has won the suit brought against them by the owners of the U. S. patents of Pierre Manhes, for infringement of U. S. patent 470,644. Judge Wallace has dismissed the bill for infringement, concluding that however much the patentee may have contributed by his other inventions to the art of smelting copper, the patent in question is destitute of merit. J. W. RICHARDS.

Zinc Production of the World. *Eng. Min. J.*, February 21, 1903.—From Henry R. Merton & Co.'s report on the production in 1902, the total, in metric tons, is 540,140, an increase of 37,782 tons over 1901, or 7.5 per cent. Of the total, Belgium, Rhine-land and Holland produced 200,140 tons (37 per cent.), United States 141,471 tons (26 per cent.), Silesia 115,280 tons (21 per cent.), Great Britain 39,610 tons (7.3 per cent.), and the rest scattering over France, Spain, Austria, Italy and Poland.
J. W. RICHARDS.

The Cyanide Process in Montana. BY M. W. ALDERSON. *Eng. Min. J.*, February 7, 1903.—In five years, the amount of gold recovered by cyaniding has increased from 5 per cent. of the total output of the state to 25 per cent. Successful cyaniding comes from an intelligent adaptation of the process to the ore. The ores of Fergus County need to be crushed to but $^1/_4$ inch, and can then be treated by percolation; the ores of Madison County are generally crushed to $^1/_{40}$ inch, and make so much slimes that they cannot be treated by percolation, but are agitated with the cyanide solution until the gold is dissolved, then allowed to settle and the clear solution syphoned off from the top.
J. W. RICHARDS.

The Dahlonega Gold District of Georgia. BY E. C. ECKEL. *Eng. Min. J.*, February 7, 1903 (Published by permission of the U. S. Geological Survey).—The gold quartz veins of this district

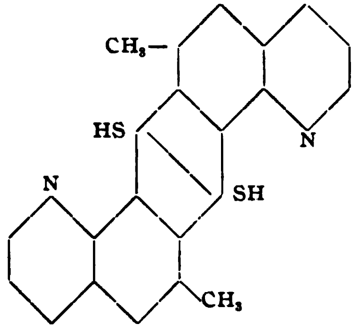
can be separated into two distinct classes, requiring very different treatment in the mine and mill. The first is the upper zone of decayed rock 50 to 100 feet deep, in which both the country rock and vein material are disintegrated to the texture of sand or gravel. This ore is free milling, the pyrite having been changed to limonite and released its gold ; it can also be mined and treated like a thick placer deposit, by hydraulicking. Below this is the solid rock, in which it is possible to mine only the vein, costing much more to mine. The ore here is sulphide, for which simple stamping and amalgamation is insufficient but chlorination is measurably successful. Considerable details of the geology and age of the deposits are given. J. W. RICHARDS.

The Manufacture of Tin Plate. BY B. E. V. LUTY. *Iron and Machinery World*, February 21, 1903.—A very readable paper, not very technical, but describing, in a popular way, the various steps of this manufacture. J. W. RICHARDS.

Bauxite Mining in Arkansas. *Eng. Min. J.*, February 28, 1903.—The Pittsburg Reduction Company is now mining bauxite at Bauxite, Saline County. Part of the ore is first washed to remove free silica; part can be treated without washing. A cylindrical dryer is used, fired with wood. In calcining, a 60-foot rotary furnace is used, fired by gas generated in a 10 by 12-foot Duff water-seal gas-producer. The ore is then ground, loaded into cars, and shipped to the new alumina plant of the same company, at East St. Louis, which is the most complete plant of its kind in the country. J. W. RICHARDS.

ORGANIC CHEMISTRY.

On the Action of the Halogens and the Sulphur Halides Upon Paratoluquinoline. BY JOHN B. EKELEY. *Univ. of Colorado Studies*, 1, 159–183.—By the action of sulphur monochloride (S_2Cl_2) upon *p*-toluquinoline, a base can be obtained crystallizing from acetic acid in small, white needles, m. p. 316°, which the author designates as "*p-toluthioquinanthrene*," assigning to it the following formula :



Edinger's "thioquinanthrenes" should be assigned a similar structure. As the sulphur atoms in these compounds appear to possess basic properties, the name "dithionium bases" is suggested for the class. *p*-Toluthioquinanthrene gives beautiful crystalline salts with mineral acids and with picric acid. The *sulphate* crystallizes in two modifications—$C_{20}H_{16}N_2S_2.2H_2SO_4$, gleaming yellow needles; and $C_{20}H_{16}N_2S_2.2H_2SO_4.2H_2O$, scarlet needles. Both forms are decomposed when heated with water. *Nitrate*, $C_{20}H_{16}N_2S_2.4HNO_3$, long golden needles; *chloride*, $C_{20}H_{16}N_2S_2.2HCl$, microscopic yellow needles (from xylene); *bromide*, $C_{20}H_{16}N_2S_2.2HBr$, yellow; *picrate*, $C_{20}H_{16}N_2S_2.2C_6H_2(NO_2)_3OH$, yellow needles; *methiodide*, $C_{20}H_{16}N_2S_2.2CH_3I$, red needles (from water). *Salts of Thioquinanthrene.—Nitrate*, $C_{18}H_{12}N_2S_2.4HNO_3.2H_2O$, crystalline solid decomposing at 80°–100°; *sulphate*, $C_{18}H_{12}N_2S_2.2H_2SO$, red-brown needles; *chloride*, $C_{18}H_{12}N_2S_2.2HCl$; *bromide*, $C_{18}H_{12}N_2S_2.2HBr$. *Salts of the base from o-Toluquinoline.—Nitrate*, $C_{18}H_{12}N_2S_2.4HNO_3.2H_2O$, yellow crystals decomposing at 80°–100°; *sulphate*, $C_{18}H_{12}N_2S_2.2H_2SO$, red-brown needles; *chloride*, exists in two modifications, $C_{18}H_{12}N_2S_2.2HCl$, microscopic scarlet needles, and $C_{18}H_{12}N_2S_2.2HCl.2H_2O$, yellow crystals; *bromide*, $C_{18}H_{12}N_2S_2.2HBr$, dark red substance. *Bromine Addition-Products of the Bases.*—By the action of bromine upon a hot acetic solution of *p*-toluthioquinanthrene, thioquinanthrene, or the isomeric thioquinanthrene from *o*-toluquinoline, bright red crystalline unstable bromine addition-products are obtained which gradually lose bromine, giving hydrobromic acid salts, and finally, by loss of bromine and hydrobromic acid, reverting to the free base again. *Action of Sulphur Dichloride* (SCl_2) *upon p-Toluquinoline.*—The interaction of these substances at 120° produces the *p*-toluthioquinanthrene, together with *di*- and *tri-chlor-p-toluquinoline.* The di-chlor-quinoline crystallizes from alcohol in snowy needles, m. p. 80°–81°, soluble in dilute hydrochloric acid; its *methiodide*, $C_{10}H_7NCl_2.CH_3I$, crystallizes from alcohol in red needles; its *chlorplatinate*, $(C_{10}H_7NCl_2)_2H_2PtCl_6$, separates when platinic chloride is added to a hydrochloric acid solution of the base. The tri-chlor-quinoline separates from alcohol in white crystals, m. p. 159°, insoluble in dilute hydrochloric acid.—*The Action of Sulphur Monobromide* (S_2Br_2) *on p-Toluquinoline* does not give a thioquinanthrene but *monobrom-p-toluquinoline*, crystallizing from alcohol in white needles, m. p. 84°–85°; its *chlorplatinate* forms yellow needles. By the *Action of Bromine upon p-Toluquinoline in Presence of Fuming Sulphuric Acid* an almost quantitative yield of *bibrom-p toluquinoline* is obtained, which crystallizes from acetic acid in colorless needles, m. p. 135°–136°; platinic chloride precipitates the *chlorplatinate* from the hydrochloric acid solution of the base. In a similar manner, *diiodo-p-toluquinoline* was prepared. It crystallizes from alcohol in silky white needles, m. p. 135°–136°; its

chlorplatinate forms yellow crystals. Heated with fuming nitric acid for two hours, the diiodo compound is changed to a *nitro-iodo-p-toluquinoline*, $C_{10}H_7I(NO_2)$, crystallizing from acetic acid in yellow needles, m. p. 133°. M. T. BOGERT.

The Hydrolysis of Organic Peroxides and Peracids. BY A. M. CLOVER AND G. F. RICHMOND. *Am. Chem. J.*, **29**, 179–203.—The results of the experimental part of this paper are summarized by the authors as follows: 1. *Acid peroxides are completely hydrolyzed by water into acid and peracid.* The rapidity of the hydrolysis varies with the nature of the peroxide and its solubility in water, but the change is a complete one and non-reversible; ROOR + HOH = ROOH + ROH. In case the radicals are dissimilar, the hydrolysis may occur in two ways, ROOR' + HOH giving either ROOH + R'OH or R'OOH + ROH. Other bodies are also formed in these reactions, their formation being due to the fact that peracids in aqueous solution are extremely reactive towards substances capable of hydrolysis, such as acid chlorides, anhydrides and peroxides; R'OOH + ROR = ROOR' + ROH, and R'OOH + ROOR = R'OOR + ROOH. In all cases a peroxide is formed, together with an acid or peracid. In case the peroxide is formed faster than it is hydrolyzed, it will, of course, accumulate. 2. *Peracids are hydrolyzed into acid and hydroperoxide,* ROOH + HOH = HOOH + ROH. This change is a much slower one than with the peroxide, occurring most rapidly in acid solution, and being non-reversible. *Acetic peroxide* can be prepared in good yield (76 per cent. of theory) by the action of acetic anhydride upon barium dioxide, and can be crystallized by cooling its ligroin solution in a freezing-mixture. Its solubility in water at 25° appears to be 54.2 grams per liter. It liberates iodine from potassium iodide solution, and is very explosive. On hydrolysis, it yields acetic peracid and acetic acid, the peracid in turn, being further hydrolyzed to acetic acid and hydroperoxide. The absence of hydroperoxide among the products of the first hydrolysis was proved by the usual tests, while the behavior of the solution with acetic anhydride and with benzoyl chloride indicated the presence of acetic peracid. All attempts to isolate this peracid from its solutions failed. Its solution is recommended for oxidizing purposes for the following reasons: 1, it is easily prepared; 2, a very concentrated solution may be made; and 3, it is an organic oxidizing agent whose reduction product is unobjectionable. *Propionic peroxide*, prepared from propionic anhydride and barium dioxide, is miscible with all ordinary solvents, its saturated aqueous solution containing 15.9 grams per liter. At 80° it begins to decompose. On hydrolysis it behaves like the acetic peroxide. *Crotonic peroxide. Crotonic anhydride* was prepared by Autenrieth's method. The pure substance boils at 128°–130° at 19 mm., with slight decomposition. Sp. gr. at 29°/29°, 1.0338. It does not solidify at −15°. By the action of hydro-

peroxide and barium dioxide, crotonic anhydride may be changed to crotonic peroxide, which crystallizes from ligroin in needles and irregularly-shaped plates, m. p., 41°. It is odorless, explodes gently on heating, does not decompose on long standing, and is soluble in all ordinary solvents. *Benzoic acetic peroxide*, on hydrolysis, breaks up into benzoperacid and acetic acid ; the benzoperacid then attacks the unchanged benzoic acetic peroxide forming benzoic peroxide and acetperacid. The presence of a small amount of acetic or mineral acid retards or prevents the formation of benzoic peroxide from the benzoic acetic peroxide. A freshly prepared solution of acetic peroxide, treated with a solution of benzoperacid, soon becomes turbid from the separation of benzoic acetic peroxide, while a hydrolyzed solution of acetic peroxide does not show this behavior. *Benzoperacid* was prepared from benzoic anhydride, potassium hydroxide solution and hydroperoxide at 0°, filtering from benzoic peroxide, acidifying the filtrate with cold, dilute, sulphuric acid, and collecting the peracid in chloroform. This peracid hydrolyzes to hydroperoxide and benzoic acid. *Phthalic monoperacid* suffers a similar change, but with much greater rapidity. M. T. BOGERT.

On the Preparation of the Nitrosobenzaldehydes (preliminary communication). BY FRIEDRICH J. ALWAY. *Ber. d. chem. Ges.*, 36, 793–794.—By the action of zinc dust upon a glacial acetic solution of *p*-nitrobenzaldehyde, three substances are obtained : 1. The N-*p*-formylphenylether of *p*-nitrobenzaldoxime, $O_2N.C_6H_4.\underset{\diagdown\,O\,\diagup}{CH—N}.C_6H_4.COH$; 2. a red insoluble substance, apparently $HOC.C_6H_4.\underset{\diagdown\,O\,\diagup}{N—CH}.C_6H_4.\underset{\diagdown\,O\,\diagup}{N-N}.C_6H_4.\underset{\diagdown\,O\,\diagup}{CH—N}.C_6H_4.COH$; and 3. a yellow body of unknown constitution, apparently a condensation product of *p*-hydroxylaminobenzaldehyde. The amount of each substance obtained depends upon the conditions of the experiment. The same three bodies are obtained by dissolving *p*-nitrobenzaldehyde in alcohol, adding zinc dust and then acetic or hydrochloric acid, or by reducing the aldehyde electrolytically in concentrated sulphuric acid. All three substances yield *p*-nitrosobenzaldehyde when oxidized with chromic acid. The red substance is insoluble in all ordinary solvents, explodes on heating, and is oxidized to *p*-nitroso- and *p*-azoxy-benzaldehyde by ferric chloride. By dissolving *p*-nitrobenzaldehyde in glacial acetic acid, adding zinc dust without cooling, oxidizing the mixture with potassium dichromate and distilling with steam, a better yield of *p*-nitrosobenzaldehyde is obtained than by the method formerly described. The behavior of *m*-nitrobenzaldehyde is similar to that of the para compound. M. T. BOGERT.

On Acylhalogenamine Derivatives and the Beckmann Rearrangement. By Edwin E. Slosson. *Am. Chem. J.*, 29, 289–319.—A. W. Hofmann's method of preparing amines from amides, by changing the latter to bromamides and treating these with aqueous alkali, involves a molecular change similar to the Beckmann rearrangement. According to the views of Stieglitz, the alkali removes hydrobromic acid from R.CO.NHBr giving R.CO.N :, the univalent nitrogen atom then taking the radical away from the carbon, giving an isocyanate as the first product of the reaction, from which the other products are derived. According to this hypothesis, if the hydrogen of the —NHBr group be replaced by an alkyl or alphyl, no rearrangement should occur, since hydrobromic acid cannot then be split off ; and the experiments reported in the present paper show clearly that the Beckmann rearrangement does not occur with bodies of the types R.CO.NR′(Hal) or RC(OR′) : NHal. Incidentally, the structure of the chlor- and bromamides is shown to be RCONH(Hal) and not RC(OHal) : NH. Further it was found impossible to prepare stereomers of the imino ethers RC(OR′) : NHal.—Experimental. *The preparation of alphylacylhalogenamines.* These substances were prepared by the action of hypochlorous or hypobromous acid upon the amide. One difficulty in the preparation arises from the ease with which these compounds rearrange to the more stable halogenated alphylamides, $RCON(Hal)C_6H_5$ = $RCONH(C_6H_4Hal)$. *Phenylacetylchloramine*, $CH_3CONClC_6H_5$, is quite stable when pure and dry, and melts at 91°. With potassium hydroxide or sodium methylate it gave only acetanilide and no methylaniline. Its chlorine atom could not be replaced by ethyl by the action of zinc ethyl, or by cyanogen by the action of potassium cyanide. *Methyl phenylmethylcarbamate*, $C_6H_5NCH_3.COOCH_3$, prepared from methylaniline and methylchlorcarbonate, is a light yellow oil of fishy odor, boiling at 235°, and is not attacked by sodium hydroxide solution. *Piperidyl cyanide*, from chlorpiperidine and potassium cyanide, is a colorless, fragrant oil, boiling at 122°–124° at 30 mm., and is insoluble in water. *p-Chloraniline.* An almost quantitative yield of *p*-chloraniline can be obtained by treating acetanilide with chlorine and heating the resultant *p*-chloracetanilide to 150° with concentrated sulphuric acid. *Phenylacetylbromamine*, $CH_3CO.C_6H_5NBr$. Yellow flakes or four-pointed stars, melting at 94°–95° with rearrangement to *p*-bromacetanilide. It is very unstable and suffers this rearrangement even on standing for a few minutes in warm moist air. It does not undergo any Beckmann rearrangement. *Phenylformylchloramine*, $HCONClC_6H_5$, melts at 44°, and can be heated to 120° without much decomposition. By hydrochloric acid and certain other agents it is changed to *formyl-p-chloranilide*, colorless crystals, m. p., 101°. *Phenylformylbromamine.* Slightly yellow needles, m. p., 79°–80°, decomposing spontaneously even

in dry air, and easily changed to *p*-bromformanilide by acids, alkalies, or heat. *Phenylbenzoylchloramine*, $C_6H_5CONClC_6H_5$. Large, transparent crystals, m. p. 81.5°–82°, does not suffer a Beckmann rearrangement to the slightest extent, but is readily changed to *p-chlorbenzanilide*, the latter forming fine cubical crystals, m. p. 187°–187.5°. *p-Tolylformylchloramine*, $HCONClC_7H_7$, melts at 49°–50° and decomposes at 140°. *p-Tolylformylbromamine*, pure white, m. p. 80°, extremely unstable. *α-Naphthylformylchloramine* melts at 63° and is very unstable. *β-Naphthylformylchloramine* melts at 75°. *α-Naphthylacetylchloramine*, $C_{10}H_7NClCOCH_3$. Fine, pure white crystals, m. p. 75°. *Ethylbenzoylchloramine*, $C_6H_5CONClC_2H_5$. Very fine white needles, m. p. 53.5°, very stable, its chlorine not being displaced by the action of zinc ethyl or potassium cyanide. *Ethyl-m-nitrobenzamide*, from the acid chloride and ethylamine, melts at 120°, and is not chlorinated by the action of hypochlorous acid. *Methylbenzoylchloramine* is a colorless oil, heavier than water, not solidifying at —16°. It is easily decomposed by various agents and invariably yields methylbenzamide with no trace of a Beckmann rearrangement. It is much less stable than the ethyl derivative. *Amylacetamide*, from acetyl chloride and amylamine, is an oil which forms a pale yellow *chlorplatinate*. *Amylacetylchloramine* is a very stable, colorless oil. The same product was obtained from amylacetamide and hypochlorous acid as by acetylating amylchloramine, from which it is clear that the formula of the compound must be $CH_3CONClC_5H_{11}$. *Ethylchlorimidobenzoate* does not give Berg's reaction with potassium cyanide; with zinc, ethyl benzonitrile is the chief product with a little ethylamine. *Ethylchlorimido-m-nitrobenzoate*, $O_2NC_6H_4C(NCl)OC_2H_5$. Slender white needles, m. p. 61°, at higher temperatures giving mainly *m*-nitrobenzamide with a little ethyl-*m*-nitrobenzoate but no nitraniline derivative. All attempts to prepare stereomers failed. Dimethylaniline or *α*-naphthol and alkali do not react with the chlorine atom. The body is very stable and suffers no Beckmann rearrangement. *Ethyl bromimido m-nitrobenzoate*, fine white needles, m. p. 71°. *Ethylchlorimido-β-naphthoate*, stellar groups of needles and plates, m. p. 71°; with potassium cyanide it does not give the Berg reaction nor is its chlorine replaced by ethyl by the action of zinc ethyl. *Ethyl bromimido-β-naphthoate*, pure white needles, m.p. 76.5°–77°, remarkably stable.

M. T. Bogert.

Diphenylstyrylcarbinol. By Elmer P. Kohler. *Am. Chem. J.*, 29, 352–363.—Tertiary alcohols, like triphenylcarbinol, which contain only aryl groups, possess properties very different from those tertiary alcohols which, like diphenylmethylcarbinol, contain at least one alkyl group. The preparation of diphenylstyrylcarbinol was undertaken to study the influence of an alkylene group in these alcohols. *Diphenylstyrylcarbinol* can be prepared

by the Grignard reaction, by allowing one molecule of benzylideneacetophenone to act upon two of phenyl magnesium bromide and then decomposing the product with cold dilute sulphuric acid. It crystallizes in colorless needles, m. p. 96°, and distils undecomposed under diminished pressure. In concentrated sulphuric acid it dissolves, forming a lemon-yellow solution, from which it is reprecipitated unchanged by dilution. This halochromism, characteristic of triphenylcarbinols, is very weak, being only one three-hundredth that of triphenylcarbinol itself. Reduced with sodium or sodium amalgam, it gives an *oil*, apparently the corresponding saturated alcohol. With zinc dust and glacial acetic acid, however, a dimolecular reduction product is obtained:

$$\begin{array}{l} C_6H_5.CH.CH_2.C(OH)(C_6H_5)_2 \\ \quad\ \ | \\ C_6H_5.CH.CH_2.C(OH)(C_6H_5)_2 \end{array} \quad \text{or,} \quad \begin{array}{l} C_6H_5.CH_2.CH.C(OH)(C_6H_5)_2 \\ \qquad\qquad\ \ | \\ C_6H_5.CH_2.CH.C(OH)(C_6H_5)_2 \end{array}$$

This forms small plates, m. p. 195°. Oxidation of diphenylstyrylcarbinol gives benzoic acid and benzophenone. With bromine it forms a very unstable addition product, which loses hydrobromic acid giving a stable *bromdiphenylstyrylcarbinol*, colorless plates, m. p. 163°. *Diphenylstyrylchlormethane* cannot be obtained from the carbinol and hydrochloric acid, but only by the actionof phosphorus pentachloride. It forms large, lustrous, monoclinic prisms, m. p. 91°, and is very inactive. When two molecules of benzylideneacetophenone act upon one of phenylmagnesium bromide and the product is decomposed by water, a substance is obtained which the author believes to be a combination of one molecule benzylideneacetophenone with one of diphenylstyrylcarbinol:

$$\begin{array}{l} \qquad\quad C_6H_5.CH.CH_2.C(OH)(C_6H_5)_2 \\ \qquad\qquad\quad\ \ | \\ C_6H_5.CH{:}C.CO.C_6H_5 \end{array}$$

It melts at 180°, and when distilled at 20 mm. breaks up into benzylideneacetophenone, diphenylstyrylcarbinol and a yellow *oil* of unknown composition. It dissolves in concentrated sulphuric acid with blood-red color. A third substance obtained by decomposing with water the reaction-product of benzylideneacetophenone and phenylmagnesiumbromide, formed in largest amounts when equal molecules of the two react, is a clear colorless *oil* of undetermined structure. M. T. BOGERT.

The Action of Zinc on Triphenylchlormethane. BY M. GOMBERG. *Am. Chem. J.*, 29, 364–371.—A reply to the article by Norris and Culver (*Am. Chem. J.*, 29, 129 (1903)) upon this subject. The author presents facts showing that the claim of Norris and Culver that "the work already done has brought to light a number of facts overlooked by Gomberg" cannot be upheld. M. T. BOGERT.

On Some Condensation Products of the Pseudothioureas: Synthesis of Uracil, Thymine, and Similar Compounds. BY HENRY F. WHEELER AND HENRY F. MERRIAM. *Am. Chem. J.*, **29**, 478–492.—Pseudothioureas have not been used in any synthetic processes whatever and yet they are more reactive in general than the normal ureas. The free pseudothioureas were not isolated, although they appear to be much more stable than supposed, but the experiments were carried out with their halogen hydrides. With ketonic esters pyrimidines were obtained :

$$\begin{array}{ccccccc}
 & NH_2 & C_2H_5OCO & & \overset{(3)}{HN} - & \overset{(4)}{CO} & C_2H_5OH \\
 & | & | & & | & | & \\
CH_3S- & C \quad + & C.CH_3 & = CH_3S- & C_{(2)} & _{(5)}C.CH_3 + & \\
 & \| & \| & & \| & \| & \\
 & NH & HO-CH & & \underset{(1)}{N} - & \underset{(6)}{CH} & H_2O
\end{array},$$

while with amino acids, guanidine acids are formed: $HN:C(NH_2)SR + H_2NCH_2COOH = HN:C(NH_2)NH.CH_2COOH + RSH$. EXPERIMENTAL.—*Pseudomethylthiourea hydriodide* is prepared from thiourea and methyl iodide, and the *pseudoethylthiourea hydrobromide* in similar manner by the action of excess of ethyl bromide upon thiourea. *2-Methylmercapto-6-oxypyrimidine.* From pseudomethylthiourea hydriodide and sodium formylacetic ester in presence of alkali, subsequently acidifying with acetic acid. Yield, 46 per cent. It crystallizes from water in long prisms or short lozenge-shaped tablets, m. p. 198°–199°. *2-Ethylmercapto-6-oxypyrimidine.* Prepared in similar manner. Yield as high as 68.8 per cent. Small, colorless, stout prisms and pyramids, m. p. 152°. *Uracil.* Prepared from the last compound by boiling with concentrated hydrochloric acid. Yield, 94.4 per cent. Crystallizes from water in balls of minute, pure white needles, melting at 338° when rapidly heated. Boiled with alkali and the solution then acidified, it precipitates unchanged. It forms an amorphous silver salt, soluble in excess of ammonia or nitric acid, but does not form a picrate. *5-Bromuracil*, from the action of bromine upon a carbon bisulphide solution of uracil, crystallizes from water in small, colorless, stout prisms, turning dark above 200° and melting with effervescence at about 293°. *2-Methylmercapto-4-methyl-6-oxypyrimidine*, from pseudomethylthiourea hydriodide and acetoacetic ester, forms long prisms, m. p. 219° (same as given by List), and is soluble in acids or alkalies. Boiled with hydrobromic acid, it is converted into Behrend's 4-methyluracil. *2-Methylmercapto-5-methyl-6-oxypyrimidine*, from pseudomethylthiourea hydriodide and sodium formylpropionic ester subsequently acidifying with acetic acid. Yield, 20 per cent. It crystallizes from water in small plates, sintering at about 225° and melting at 233°. Boiled with concentrated hydrochloric acid, it yields *thymine* (yield, 99 per cent.). The latter crystallizes from water in small, apparently rectangular, colorless plates, melt-

ing at 326° when rapidly heated, and identical with the thymine obtained from the nucleic acid of the spleen. 100 parts of water at 25° dissolve 0.404 parts of thymine. *2-Ethylmercapto-4,5-dimethyl-6-oxypyrimidine*, from pseudoethylthiourea hydrobromide and methylacetoacetic ester in presence of alkali, subsequently acidifying with hydrochloric acid. Crystallized from a mixture of alcohol and ether, it forms stout prisms, sintering at about 151° and melting at about 156°. Another substance is formed in this reaction, which the authors think may be *acetomethylacetylcyanamide*, $CH_3CO(CH_3)CHCONHCN$. *4,5-Dimethyluracil*, obtained from the above ethylmercapto body by boiling with hydrochloric acid, crystallizes from alcohol in microscopic needles, melting with partial decomposition at 292°. *2-Methylmercapto-4-methyl-5-ethyl-6-oxypyrimidine*, from pseudomethylthiourea hydriodide and ethyl ethylacetoacetate, crystallizes from alcohol in long, flat, colorless prisms with branching, brush-like edges, sintering at 201°–202° and melting at about 203° with slight effervescence. Boiled with concentrated hydrochloric acid it is changed to *4-methyl-5-ethyluracil*, which crystallizes from alcohol in irregular, colorless leaflets, sintering at about 230° and melting at 237°. *2-Methylmercapto-4-phenyl-6-oxypyrimidine*, from pseudomethylthiourea hydriodide and benzoylacetic esters, crystallizes from alcohol in long, slender needles, m. p. 240°. Heated with concentrated hydrochloric acid, it yields *4-phenyluracil*, crystallizing from alcohol in microscopic prisms, m. p. 269°–270°. *Guanidinacetic acid* (*Glycocyamine*) is formed from pseudomethylthiourea hydriodide and glycine; rectangular plates, decomposing at 250°–260° without melting. *Picrate*, long, bright yellow needles, melting with decomposition at about 202°. *Orthoguanidinebenzoic acid*, prepared in similar manner from anthranilic acid, does not melt at 260°. Dissolved in sodium hydroxide solution and reprecipitated with carbon dioxide, it gives *o*-benzglycocyamidine. *Pseudomethylthioureachloracetate*, $H_2NC(SCH_3):NH,ClCH_2COOH$, from pseudomethylthiourea and chloracetic acid, crystallizes from alcohol in transparent, rectangular plates, m. p. 162°.

M. T. BOGERT.

Synthesis of Aminooxypyrimidines Having the Composition of Cytosine: 2-Amino-6-Oxypyrimidine and 2-Oxy-6-Aminopyrimidine. BY HENRY L. WHEELER AND TREAT B. JOHNSON. *Am. Chem. J.*, **29**, 492-504.—Recent investigations of Kossel and Steudel lead them to the conclusion that cytosine is an aminooxypyrimidine, and they further state that by the action of nitrous acid it is converted into a substance having the properties of uracil. The authors of the present paper, therefore, undertook the synthesis of those aminooxypyrimidines which might yield uracil by suitable treatment, and in 2-oxy-6-aminopyrimidine have obtained a substance which appears to be identical with natural cytosine. The method of synthesis was as follows: The

ethyl bromide addition-product of thiourea was condensed with sodium ethylformylacetate in presence of alkali, the mixture being later acidified with acetic acid :

$$\begin{array}{ccccccc} NH_2 & & C_2H_5OCO & & NH\text{—}CO & & \\ | & & | & & |\quad\quad | & & C_2H_5OH \\ C_2H_5SC & + & C & = & C_2H_5SC\quad CH & + & \\ \| & & \| & & \|\quad\quad \| & & NaOH \\ NH & & NaOCH & & N \text{ — } CH & & \end{array}$$

The 2-ethylmercapto-6-oxypyrimidine thus obtained was then changed to the 2-ethylmercapto-6-chlorpyrimidine by the action of phosphorus pentachloride, the chlorine was then replaced by the amino group by heating with alcoholic ammonia, and the mercapto group finally split off by boiling with hydrobromic acid. The isomeric 2-amino-6-oxypyrimidine was prepared by condensing sodium formylacetic ester with guanidine:

$$\begin{array}{ccccccc} NH_2 & & C_2H_5OCO & & NH\text{—}CO & & \\ | & & | & & |\quad\quad | & & C_2H_5OH \\ H_2N\text{—}C & + & CH & = & H_2N\text{—}C\quad CH & + & \\ \| & & \| & & \|\quad\quad \| & & NaOH \\ NH & & NaOCH & & N \text{ — } CH & & \end{array}$$

EXPERIMENTAL.—*2-Ethylmercapto-6-chlorpyrimidine* is obtained from the corresponding oxypyrimidine by the action of phosphorus pentachloride, the yield being 92–94 per cent. It is an oil, which gives uracil when boiled with hydrochloric acid. Heated with alcoholic ammonia in a sealed tube, *2-ethylmercapto-6-aminopyrimidine* is obtained in a yield of 82–84 per cent. (crude product), and crystallizes from 50 per cent. alcohol in colorless plates, m. p. 85°–86°. *Cytosine*, or *2-oxy-6-aminopyrimidine*, is prepared from the ethylmercapto compound by boiling it with hydrochloric acid until no more mercaptan is evolved, the yield of cytosine being as high as 90 per cent. The free base crystallizes from water in beautiful colorless transparent plates, probably of the mono- or triclinic system, and containing one molecule of water; they decompose with effervescence at 320°–325° (uncorr.), and dissolve in 129 parts of water at 25°. Solutions of the base are precipitated by phosphotungstic acid; acidified solutions give a brick-red precipitate with potassium bismuth iodide. Cytosine gives the murexide reaction, forms easily soluble salts with hydrochloric or sulphuric acids, while the chlorplatinate, chloraurate and picrate are not readily soluble in water. *Picrate*: bright yellow needles or very slender needle-like prisms, decomposing at 300°–305°. 0.076 part of the picrate dissolves in 100 parts of water at 25°. *Chlorplatinate*: yellow flakes. *2-Oxy-6-acetaminopyrimidine*, from the amino derivative and acetic anhydride, crystallizes from water in colorless, microscopic prisms, frequently in crosses, and not melting at 300°. *Phenylisocyanate derivative of 2-oxy-6-aminopyrimidine.* Two molecules of the

isocyanate unite with one of the base to a white crystalline insoluble substance, sintering at 255° and melting with violent effervescence at 260°. By the action of bromine upon a glacial acetic solution of 2-oxy-6-aminopyrimidine and crystallization of the product from water, colorless needles were obtained melting sharply at 247° with effervescence; dissolved in water and the solution made alkaline with ammonia, a brick-red *substance* separated which had no definite melting-point. *2-Amino-6-oxy-pyrimidine* was prepared from guanidine and sodium ethylformylacetate, the yield of crude substance being 36–39 per cent. It crystallizes from water in small flat colorless transparent prisms, or long, slender, colorless, silky needles, and decomposes with violent effervescence at about 276°. The base is precipitated by phosphotungstic acid, with potassium bismuth iodide it gives a brick-red precipitate in sulphuric but not in hydrochloric acid solution, it gives the murexide reaction, its hydrochloric and sulphuric acid salts are readily soluble in water (the latter crystallizing in flat prisms), and its chlorplatinate and chloraurate are not very soluble. Heated at 145°–150° with 20 per cent. sulphuric acid, a portion is changed to uracil. *Picrate*: bright yellow crystals, which effervesce at 270°–280°, and dissolve in 1200–1300 parts of water at 25°. *Chlorplatinate*: small yellow crystals decomposing above 200°. *Chloraurate*: bright yellow, stout prisms which readily form supersaturated solutions. *2-Acetamino-6-oxypyrimidine*, from the base and acetic anhydride, crystallizes from alcohol in minute mother-of-pearl scales, m. p. 247°. *2-Amino-5-brom-6-oxypyrimidine* was prepared by the action of bromine upon the base suspended in glacial acetic acid, the yield of hydrobromic acid salt being 83 per cent. This salt separates from water in long, slender, needle-like prisms, melting at about 273° with effervescence. The free base is liberated from this salt by the action of ammonia upon its aqueous solution. It crystallizes from strong acetic acid in pointed plates, melting with decomposition at about the same point as its bromide. It has acid properties and dissolves in strong ammonia water.

M. T. BOGERT.

On Cytosine or 2-Oxy-6-aminopyrimidine from Tritico-Nucleic Acid. BY HENRY L. WHEELER AND TREAT B. JOHNSON. *Am. Chem. J.*, 29, 505–511.—The authors obtained from the nucleic acid of wheat embryo a cytosine which they compared with their synthetic cytosine (see preceding review) and with the cytosine from spleen. All three showed the same effervescing point when heated, the same solubility in water at 25°, and their chlorplatinates were found to be crystallographically identical, from which facts, taken in conjunction with analytical data, the authors conclude that the three products are identical in all respects, and that natural cytosine is clearly 2-oxy-6-aminopyrimidine and

should be represented by the following or a tautomeric formula :

$$\begin{array}{l} N = C-NH_2 \\ | \qquad | \\ CO \quad CH \qquad .H_2O \\ | \qquad \| \\ NH-CH \end{array}$$

As cytosine has hitherto been found only in animal organs, the present results offer further evidence of the similarity of nucleic acids of animal and vegetable origin. M. T. BOGERT.

Identification of Organic Acids by Their Toluides. BY HEYWARD SCUDDER. *Am. Chem. J.*, **29**, 511–513.—Toluides may be rapidly and conveniently prepared by heating a salt of the acid with concentrated hydrochloric acid and the toluidine. The salt used need not be anhydrous. The toluide is best purified by crystallization from benzene or petroleum ether. Very small amounts can be used and the yield is good. Formic acid gives mainly oxaltoluide. In the case of most solid acids and acids of high boiling-point, the free acid may be used instead of the salt. Oxalic and most acids which readily form anhydrides when heated, do not require the addition of any hydrochloric acid.

M. T. BOGERT.

The Morphology of Certain Organic Compounds. BY AUSTIN F. ROGERS. *School of Mines Quart.*, **24**, 130–135.—A crystallographic study of the following organic compounds: Potassium cyanate, allyl thiourea, acetoxime, acid ammonium salt of *o*-sulphobenzoic acid (salt on sulpho group), mercury oxycyanide, benzyl thiocyanate, and *n*-propyldithiocarbamate.

M. T. BOGERT.

BIOLOGICAL CHEMISTRY.

The Work Performed by the Diagnosis Laboratory of the Department of Health, in Connection with Ehrlich's Diazo Reaction During 1902. BY J. S. BILLINGS, JR. *N. Y. Med. Jour.*, **77**, 676–678.—The results of this investigation show that the examination of the urine in cases of suspected typhoid fever is of value, provided that its limits are recognized. While not so absolutely pathognomonic of typhoid fever, yet the diazo reaction is even more constantly present in that disease than the Widal reaction ; so that its absence at a period when it should be present, if the case is one of typhoid fever, is of considerable value in making a negative diagnosis. In a majority of instances the diazo reaction is present in the urine at least forty-eight hours earlier than the Widal reaction in the blood. It disappears much earlier than the Widal reaction, however, and negative results obtained later than the second week are of little or no value. "Doubtful reactions" have slight significance.

F. P. UNDERHILL.

III. On the Quantitative Determination of Urea in the Urine. BY OTTO FOLIN. *Ztschr. phys. Chem.*, 37, 548–551.—The author answers various criticisms concerning his method for the quantitative estimation of urea in the urine, and maintains that it gives correct values. F. P. UNDERHILL.

The Immunity of Fundulus Eggs and Embryos to Electrical Stimulation. BY ORVILLE H. BROWN. *Am. J. Physiol.*, 9, 111–116.—The eggs of Fundulus are immune to electrical currents just as they are to osmotic changes of the medium in which they live. This fact is an interesting physiological confirmation of the theory of the osmotic nature of electrolytes. The most probable explanation appears to be that the membranes of the egg are so freely permeable to ions and possibly to neutral particles that no polarization can occur. This conclusion is supported by the behavior of Arbacia and Asterias eggs, which show the contrary relation, being readily susceptible both to electrical and to osmotic changes. There is a gradual increase in susceptibility to osmotic changes and to the electric current as the embryo develops, the adult fish being quite readily stimulated by the current from a single cell, which is quite without action in the embryo. It is suggested that the resistance of the electric and other fishes to electric stimulation, may not improbably be similarly explained by the permeability of the walls of their tissue cells to ions. The liquefaction of the eggs on the anode side, and the quieting effect of the anode, supports Mathews' hypothesis of the dissolving action of the cathions and their inhibitory action.

F. P. UNDERHILL.

On the Inorganic Composition of the Medusae, Aurelia Flavidula and Cyanea Arctica. BY A. B. MACALLUM. *J. Phys.*, 29, 213–242.—The results of the determination of the inorganic composition of aurelia and cyanea may be summarized as follows: The degree of salinity of these forms, as indicated by the amount of total halogen, may be, and probably is, different from that determined in the sea water from which they were taken, and even the degree of salinity of the two forms, though found in the same sea water and on the same day, is not the same. As regards each of the constituents more especially, taking the total halogen as the standard, the sodium is slightly less and the potassium slightly more than in sea water. In the two forms the amounts of potassium determined are in the proportion which exists between the amounts of proteid nitrogen found in them. Also, while the lime is present practically in the proportions found in sea water, the magnesia is less and the deficiency may reach 10 per cent. (cyanea). Further, the sulphuric acid (SO_3), is deficient to the extent of 32–36 per cent. These results indicate that the cells lining the gastro-vascular channels, and perhaps also to some extent those covering the organisms, exert a selective action in ab-

sorbing the salts of sea-water and that the selective action varies, being more vigorous in the case of some constituents than in others. The inorganic composition of the Medusae reflects to a certain extent the composition of the sea-water, not only of to-day, but also of past, perhaps very remote, geological periods. As regards other inorganic constituents the iron is more, and the iodine less abundant than in sea-water. The iodine does not appear to be associated with any compound which can be precipitated with alcohol. F. P. UNDERHILL.

The Preparation and Analysis of Some Nucleic Acids. BY P. A. LEVENE. *Ztschr. physiol. Chem.*, 37, 402–407.—The acids were obtained from the spleen and pancreas as follows: the glands were boiled in a 5 per cent. sodium chloride solution for an hour. When the mixture was cool enough, sodium acetate was added to make a 10 per cent. solution, then 50 per cent. sodium hydroxide was added until the content was 5 per cent. The mixture was allowed to stand over night. The proteids were removed with picric and acetic acids. From the filtrate the nucleic acid was precipitated with a copper chloride solution. In the analysis of the acids, the following substances were sought: the carbohydrate group, the purin bases, the pyrimidine derivatives, and the presence of glycerin. The carbohydrate group was found to be represented by furfural. Of the purin bases, adenine and guanine were present. Thymine and cytosine represented the pyrimidine derivatives. No glycerin was obtained. F. P. UNDERHILL.

On the Formation of Glycogen from Glycoproteids and Other Proteids. BY LYMAN BRUMBAUGH STOOKEY. *Am. J. Physiol.*, 9, 138–147.—The experimental animals employed were hens, which were starved until the glycogen had entirely disappeared from the liver. They were then fed various glycoproteids and other bodies. The glycoproteids were ovomucoid, pancreas nucleoproteid, and chondrin, and the results obtained do not permit any positive conclusions to be drawn. F. P. UNDERHILL.

On the Presence of Uracil in the Autolysis of the Pancreas. BY P. A. LEVENE. *Ztschr. phys. Chem.*, 37, 527–530.—The author has succeeded in isolating uracil from among the products of the autolytic digestion of the pancreas. In this case, only traces of thymin could be obtained. This is in opposition to the earlier work of the author when he found that comparatively large quantities of thymin could be isolated after hydrolysis of the pancreas nucleic acid. The suggestion is made that a transformation of one into the other substance may take place.

F. P. UNDERHILL.

On a Glucothionic Acid of the Spleen. BY P. A. LEVENE. *Ztschr. physiol. Cnem.*, 37, 400–402.—While attempting to isolate glycogen from the spleen, the author found a substance

which did not give the color reactions of glycogen, and did not reduce Fehling's solution until after hydration with mineral acids. On distilling with hydrochloric acid, a distillate could be obtained which yielded a small amount of furfural. An osazone could be obtained which was soluble in hot water and in alcohol, and whose melting-point was 205° C. It was further learned that the substance was a conjugate sulphuric acid, which after treatment with baryta water yielded glycuronic acid. On analysis of the substance it yielded

	Per cent.
S	3.
N	5.43

According to its composition it is closely allied to the chondroitin sulphuric acids. F. P. UNDERHILL.

PHARMACEUTICAL CHEMISTRY.

A Method for the Preparation of Medicinal Manganese Dioxide. BY AUGUST GOTTHELF, PH.D. *Am. Jour. Pharm.*, 75, 214.—All methods for the preparation of pure manganese dioxide of approximately constant composition, with the exception of the one here proposed, were found open to the objection of being either beyond the means of the average pharmacist, or they yield products exceedingly difficult to purify. The process described by the author is that proposed by Prof. Jannasch for the quantitative estimation of manganese. The composition of the precipitate according to this authority is ($MnO_2.2H_2O$). According to the author the precipitate obtained is never a pure hydrated manganese dioxide but always contains some of the lower oxide, the percentage of which depends largely upon the temperature of drying. The method is as follows: 250 cc. each of aqua ammonia (10 per cent.) and hydrogen dioxide (3 per cent.) diluted to 1000 cc. are added with constant stirring, to a solution of 50 grams crystallized manganese sulphate ($MnSO_4.4H_2O$) in 1000 cc. water. The precipitate, after washing several times, by decantation, is transferred to a filter and washed until free from sulphate and dried at 150° C. If the manganese is poured into the alkaline solution, the proportion of dioxide falls below 43 per cent., with a corresponding increase in manganoso-manganic oxide.

It is impossible to remove all of the water of hydration of the precipitated oxide, a temperature of 150° C. being sufficient to remove a greater percentage of water without converting into the manganoso-manganic acid. The precipitate has approximately the composition 4MnO : 20 to 25 MnO_2.

The approximate yield from 50 grams of manganese sulphate is 20 grams. J. O. SCHLOTTERBECK.

Essential Oils of Fireweed and Erigeron. BY LYMAN F. KEBLER AND GEORGE R. PANCOAST. *Am. Jour. Pharm.*, 75,

216.—The authors state that genuine oil of fireweed, from *Erechthitis hieracifolia*, is a commercial rarity. When it is remembered that the name fireweed is applied to no less than six different wild plants and that the chief sources of supply are the small stills of farmers whose botanical knowledge is almost nil, it is not strange that little genuine oil finds its way into trade. Orders for fireweed oil are boldly filled with oil of *Erigeron canadense*. In the course of many years, the writers met with only two consignments that met the recognized normal constants of oil of fireweed. The sp. gr. of this oil, according to A. M. Todd, is 0.845–0.855, while the optical rotation is $-4'$ to $+4°$. F. B. Power determined these constants on another sample and gave as sp. gr. 0.838 at 18.5° C. and optical rotation as $-2°$ to $+2°$. The two consignments above spoken of gave for No. 1, sp. gr. 0.8422, optical rotation $+1°32'$. No. 2, sp. gr. 0.850° to 0.870°, optical rotation $+52°$.

In this connection the authors note that either the commercial Erigeron oils are themselves adulterated or they may vary materially in physical properties. J. O. SCHLOTTERBECK.

Some Notes on Essential Oils. M. O. WILBERT. *Am. Jour. Pharm.*, 75, 155–218.—This article, which is continued in two numbers of the Journal, is merely a compilation from the United States, British, German, and Universal Pharmacopoeias, the annual reports of the United States Treasury Department, and such standard authorities as Gildemeister and Hoffmann, Schimmel and Co., and the papers of specialists in essential oil chemistry as Wallack, Tiemann, Beckmann, Parry, Holmes, Kremers, etc. It does not represent any original work and tells nothing new, but in a concise and accurate manner states and discusses the most important facts bearing upon the source, sp. gr., and other physical constants, synthetic production, and commercial aspects of the following oils : Bitter almond, cinnamon, cloves, eucalyptus, juniper berries, lavender flowers, mustard, peppermint, rose, sandalwood, wintergreen, bergamot, lemon, limes, orange flowers, orange, anise, caraway, coriander, and fennel.

In concluding this survey of essential oils, the author favors the adoption of the active constituents of essential oils as representing the most desirable portion from a medical point of view. Thus, for example, anethol, cinnamic aldehyde, carvone, eucalyptol, eugenol, safrol, should preferably be employed in place of the respective oils from which they are derived, and to which they give their character. J. O. SCHLOTTERBECK.

INDUSTRIAL CHEMISTRY.

Cassava as a Competitor of Maize in the Production of Starch and Allied Products. BY GEORGE ARCHBOLD, PH.D. *J. Soc. Chem. Ind.*, January 31, 1903.—Prefacing this paper by the state-

ment that at the present time the demand for maize and other cereals is advancing their value so that in the near future they will not be available for the manufacture of starch, the writer calls attention to the two varieties of *manihot* known as the sweet and the bitter cassava. The plant is indigenous to the West andies and is now cultivated experimentally in Florida. From In analysis given, the writer says it is safe to assume that on the average, 25 per cent. of pure starch can be obtained from the fresh roots. Compared with maize and potatoes upon which practically the whole world depends for its supply of starch, the average yield of starch is as follows: Maize, 53; potatoes, 18; cassava, 25 per cent. An acre of ground yields forty bushels of maize, which in turn yield 1200 pounds of starch, while the same ground will yield ten tons of cassava, yielding 6720 pounds of glucose and 5600 pounds of starch. In Jamaica, where the plant grows all the year round, 20 tons per acre could be grown with ease, with proper cultivation, or nearly ten times as much starch per acre as from maize. In general, the process for working cassava starch as present being carried out in Florida is that employed by potato starch factories. The writer has, however, made some changes to better adapt the process to the differences in the raw material and has produced a process which can be worked more cheaply than that for potato starch and which is perfectly automatic and continuous. The entire process for the complete extraction of the starch from the time the roots are laid down at the factory until the starch is finished ready for the market is only three days, while maize under the most favorable conditions requires from twelve to fourteen days. The product is equal in purity to the best Bermuda arrowroot and at the same time has all of the characteristics of pure "corn starch" in all its various commercial forms. Or the starch from the boxes containing 25 per cent. of water can be broken up and converted into tapioca—a product of considerable commercial importance. It is allowed to pass into a revolving steam-jacketed cylinder and steam is applied. The heat displaces the moisture as steam, which bursts a portion of the granules of starch, causing it to assume the granular semi-lucid form so well-known as tapioca. Moreover, not only the starch and sugar of the cassava but also a considerable part of the fiber can be obtained from the pulped roots in the form of glucose, thereby producing a much sweeter and finer-flavored product and better adapted for confectionery, etc., fully 30 per cent. of the fresh root being obtained as glucose.

S. P. SADTLER.

The Application of the Sulphur Colors to the Printing of Cotton Fabrics. BY LOUIS J. MATOS. *J. Soc. Chem. Ind.*, February 23, 1903.—The sulphur colors are adapted only to cotton for which fiber they all manifest a strong affinity, so they are classed as fast dyes. They are also, as a rule,

indifferent to the majority of reagents, which places them in active competition with all cotton blacks, including aniline black itself. Sodium hydrochlorite, however, will destroy them and thus serves to distinguish dyeing with sulphur black from other cotton blacks. The most serious obstacle to the use of sulphur blacks lies in the action they have upon the design rollers or "shells" which are always of copper or alloys of copper. To nullify this destructive action on the copper printing rolls, printing pastes are made up with sodium sulphide as an integral part. This converts the color into a *leuco*-compound to be taken up by the fibers and oxidized afterwards and fixed in insoluble form. The use of lactic acid, and sugar of milk, or glucose in connection with caustic soda is also recommended as overcoming the injurious action of the sulphur compound on the copper shells. Another process purifies the sulphur color by precipitation with an acid or common salt and then acts upon the precipitate with an alkaline reducing agent like alkaline glucose or zinc dust and an alkali. The entire subject resolves itself into the problem of applying the sulphur colors or certain modifications of them in such a manner as not to act injuriously upon the copper rolls. A process of printing has been devised based on the use of nickel-plated rolls, the process being patented by the Farbenfabriken of Elberfeld Co. S. P. SADTLER.

The Manufacture of Slag Bricks and Slag Blocks. BY EDWIN C. ECKEL. *Eng. News*, **49**, 384–386.—This is an amplification of the author's article on the "Utilization of Iron and Steel Slags," prepared for the Mineral Resources of the United States for 1901, and issued in "advance extra" form but omitted from the bound volume. Slag bricks are made from granulated slag and slaked lime, while slag blocks result from the direct cooling of molten slag in molds. The methods of manufacture in vogue at different places, chiefly abroad, are described, as well as the conditions necessary for the production of satisfactory products.

W. F. HILLEBRAND.

Prospects for an American Niter Industry. BY C. C. SCHNATTERBECK. *Eng. Min. J.*, January 31, 1903.—The California nitrate deposits in the Mohave Desert, extending from the northern portion of San Bernardino County to the southern section of Inyo County, are from 80 to 100 miles from Manvel on the Santa Fé Railway. The mineral is rich, and some 22,000,000 tons are in sight. It is believed that the deposits are richer than the Chilean. The American Niter Company is planning large development, controlling about 35,000 acres; but it will be some two or three years before the property is shipping niter to the market.

J. W. RICHARDS.

Evaporated Salt Industry in Kansas. BY W. R. CRANE. *Eng. Min. J.*, February 7, 1903.—Brines are pumped from salt

wells, and evaporated by solar or artificial heat. In solar evaporation, the pans are 7 inches deep, the smaller ones, containing the stronger solution, being provided with portable arched covers running on rollers, so as to be covered in wet weather. The brine, 35 to 60 per cent. saturated, is run first into the settler, where sediment is deposited, then to the water-pan, for further clarification. Thence it flows, clear, to the lime pan, where it is concentrated by evaporation to such a point that most of the impurities, such as sulphate and carbonate of lime, crystallize out. It then passes to the pickle pan, where it concentrates until salt crystals begin to form, when it passes to the crystal pan. The mother-liquor from the crystallization is called "sump fluid," and is run off through waste launders. The crystals are put into baskets, allowed to drain, dried in an airing room and shipped in bulk. Where artificial heat is used, the brine is run into tanks with cement bottoms, and cemented sides, containing coils of iron steam-pipes. In this way the temperature is brought up to 210° to 215° F., and frequently the brine boils at 225° to 228° F. The iron pipes must be kept covered, to protect them from rapid oxidation and rusting. If it is necessary to empty a tank, the pipes are immediately covered with a protecting coating, such as whitewash. A conveyer, at the bottom of these tanks, which are called "grainers," constantly advances the deposit to one end and discharges it into an elevator which takes it up into the drying room. This industry is growing rapidly, and promises to be one of the largest mineral industries in Kansas.

J. W. RICHARDS.

The Lignite Mines of North Dakota. BY F. N. WILDER. *Eng. Min. J.*, February 28, 1903.—The output in 1902 reached nearly 300,000 tons, valued at $500,000. It is expected that the output for 1903 will be double this. In 1860 the population of both Dakotas was 4,837; now it is 720,716. Freight rates on coal averages 0.5 cent per ton-mile. Mining is done by stripping, by drifting and shafts. There is a coal bank within ten miles of nearly every settler in the state, and the farmer puts up his winter's coal as regularly as he does his hay. When mining underground, no timber is used, but 6 inches to a foot of lignite is left for a roof; in a few cases the overlying clay is so firm that all the coal is removed. Jeffrey undercutting machines are largely used. The beds are up to 14 feet thick; the cost of mining is about 60 cents per ton. J. W. RICHARDS.

The Fuel Value of North Dakota Lignites. BY F. A. WILDER. *Eng. Min. J.*, February 7, 1903.—To secure best results, appliances suited to burning the lignite must be used. The Northern Pacific Railway has constructed the Washburn locomotive, with a brick arch over the fire-box, which hauled a train of 43 cars 106 miles with a consumption of 18¼ tons of lignite, against the usual

8 tons of Eastern coal. Since the lignite cost only \$1.00 per ton, and the other \$4.00, the saving in expense was 40 per cent. Within a few years this will be the only fuel used in both Dakotas and Eastern Montana. Its evaporative power under stationary boilers is 4.1 to 4.2 times its weight of water.

J. W. RICHARDS.

The Boulder Oil Field, Colorado. BY J. E. KIRKBRIDE. *Eng. Min. J.*, February 7, 1903.—There are now 40 to 50 wells in this field, 35 to 40 of which have found more or less oil, at depths between 850 and 3,000 feet. Analysis of the oil by A. H. Low, of Denver, showed: Naphtha below 150°, 26 per cent.; light oil, from 150° to 200°, 13 per cent.; heavier oil, from 200° to 250°, 16 per cent.; heavy oil, from 250° to 300°, 17.5 per cent.; oils above 300°, 25.5 per cent.; residue, 3 per cent. Total illuminants, 46.5 per cent. Specific gravity of crude oil, at 60° F., 0.8111. A small refinery is in operation, treating 40 barrels per day. Much of the oil is being burnt crude for fuel.

J. W. RICHARDS.

The Composition of Porcelains for Electrical Purposes. BY A. S. WATTS. *Elec. World*, November 15, 1902 (from Trans. Am. Ceramic Soc.).—The materials used are slightly plastic kaolin, quartz and feldspar. Too much quartz makes the ware warp, too much feldspar increases the tendency to crack, too little feldspar produces insufficient vitrifaction and decreases insulating efficiency. The usual shrinkage in burning is 15 to 18 per cent. There must be no crazing or shivering of the enamel. The glaze may contain metallic oxides without being conducting. Tests made showed that: (1) Portland cement does not possess any more insulating power than dry air. (2) Porcelain. if not perfectly vitrified, does not insulate well, even if perfectly dry. (3) Glass ranks next, between semi-vitrified and vitrified porcelain. (4) Thoroughly vitrified porcelain, even if only 1/8 inch thick, possesses sufficient insulating strength, up to 40,000 volts. (5) Plate glass is a highly insulating body. The best porcelain for electrical purposes contains, in molecules, 0.5 to 0.8 K_2O, 0.5 to 0.2 CaO, 0.8 to 1.0 Al_2O_3, 4.2 to 6.2 SiO_2. Closer limits would be largely a matter of fancy for more translucency or stoniness. Any porcelain within the limits named above would be as good as, if not superior to, the average electrical insulator porcelain now on the market.

J. W. RICHARDS.

Self-Forming Separator in a Nickel-Peroxide Storage Cell. BY A. L. MARSH. *Elec. World*, December 13, 1902.—Nickel gauze is used as one electrode, and a plate of spongy cadmium deposited on a perforated strip of sheet-iron is the other. They are placed in position and the space between packed with freshly

precipitated, dried but still hydrated, nickel sesquioxide (Ni_2O_3). A 20 per cent. solution of potassium hydroxide is then poured in, and a tight cover with small perforation put on the cell. The wetting of the nickel oxide causes it to swell and to make good connection with the electrodes, while in a short time the oxide in contact with the cadmium becomes reduced to green monoxide, NiO, forming a thin, flocculent layer, which is a good separator, offering but slight resistance. J. W. RICHARDS.

AGRICULTURAL CHEMISTRY.

Alfalfa: Its Chemical Development, Feeding Value, and Digestibility. BY H. SNYDER AND J. A. HUMMEL. *Minn. Agr. Expt. Sta. Bull. No. 80*, pp. 149–180. —A hardy variety of alfalfa, supposed to have come originally from Norway, has been grown without difficulty in the region of Lake Minnetonka, Minnesota, for thirty years or more. Reports from farmers show the successful culture of this great forage crop in a number of counties in the central and southern portions of the state. The authors report in this bulletin studies of the chemical development, feeding-value, and digestibility of Minnesota-grown alfalfa. Analyses of samples of the first and second crops taken at weekly intervals showed that, as regards feeding-value, alfalfa is most suitable for cutting when one-third of the blossoms have appeared. When cut at a later stage, a larger amount of hay is obtained, but the feeding-value is much lessened. Six days before harvesting, the leaves constituted 42.78 per cent. of the dry matter of the plant above ground and contained 63 per cent. of the total nitrogen. During the eight days following, 6 per cent. of the nitrogenous matter of the leaves was transferred to the stems. During the ripening period the percentage of dry matter increased quite regularly in both leaves and stems. The percentage of total and proteid nitrogen decreased in the leaves, the proteid nitrogen decreasing more rapidly than the total nitrogen. In the stems the percentage of total nitrogen decreased while that of proteid nitrogen remained stationary. "This seems to show that the nitrogen is taken from the soil in non-proteids or amide forms and is changed to proteid forms in the leaves and then transferred to the stems to be finally stored in the seed." The percentage of ether extract increased in the leaves and stems. The percentage of fiber increased in the leaves but was stationary in the stems. The percentage of ash was stationary in the leaves but decreased in the stems. It is estimated that an average yield of 8,000 pounds of cured alfalfa hay per acre removes from the soil 206 pounds of potash, 58 pounds of phosphoric acid, 89 pounds of lime, and 22 pounds of magnesia. The results of digestion experiments with steers showed that alfalfa is equal in digestibility to red clover. A test of the digestibility of millet is also reported.

H. W. LAWSON.

Some Conditions of Stock Poisoning in Idaho. By H. B. Slade. *Idaho Agr. Expt. Sta. Bull. No. 37*, pp. 159–190.—This is a general discussion on the poisonous properties of plants and the conditions and treatment of stock poisoning.

H. W. Lawson.

Further Experiments in Top-Dressing Grass Land. By H. J. Wheeler and G. E. Adams. *R. I. Agr. Expt. Sta. Bull. No. 90*, pp. 69–86.—Based upon the results of experiments which have been in progress for four years, an annual application of the following mixture is recommended: Acid phosphate 400 pounds, muriate of potash 200–250 pounds, and nitrate of soda 350 pounds. Acid land should be limed before seeding to grass. The water content of field-cured hay varied from 23 to 26 per cent. During storage the loss in weight was from 13 to 16 per cent. The total nitrogen in redtop was greater than that in timothy, and more mineral matter was removed from the soil by redtop than by timothy.

H. W. Lawson.

The Relation of Carbon Dioxide to Proteolysis in the Ripening of Cheddar Cheese. By L. L. Van Slyke and E. B. Hart. *N. Y. (State) Agr. Expt. Sta. Bull. No. 231*, pp. 19–41.—The authors give the following summary of their investigations: The object of the work described in this bulletin was to ascertain the extent to which carbon dioxide is formed in American cheddar cheese during long periods of time in the process of ripening, and also to learn the mature of the chemical changes that give rise to the production of this gas. Two cheeses were used for this study. One was entirely normal, the other was made from milk containing chloroform and kept under antiseptic conditions. The investigation was continued thirty-two weeks, when a chemical study was made of the proteolytic end-products. In the normal cheese, carbon dioxide was given off continuously, though in decreasing quantities after about twenty weeks, and had not ceased at the end of thirty-two weeks. The total amount thus produced was 15.099 grams, equal to 0.5 per cent. of the fresh cheese. In the chloroformed cheese, the total amount of carbon dioxide produced was 0.205 gram, practically none being found after three weeks. In the normal cheese the following end-products of proteolysis were found: Tyrosine, oxyphenylethylamine, arginine in traces, histidine, lysine, guanidine, putrescine in traces, and ammonia. In the chloroformed cheese were found the same compounds, except oxyphenylethylamine, guanidine, putrescine, and ammonia; but arginine was found in marked quantities for the first time in cheese. A consideration of the possible sources of carbon dioxide in the two cheeses indicates that, in the case of the chloroformed cheese, the carbon dioxide came from that present originally in the milk and that formed in the milk from the decomposition of milk-sugar before treatment with chloroform. In

the case of the normal cheese, the carbon dioxide given off in its early age came largely from the decomposition of milk-sugar by lactic acid organisms, while a small amount was probably due to the carbon dioxide present in the milk and to the respiration of living organisms present in the cheese. The carbon dioxide produced after the first few weeks came apparently from reactions taking place in some of the amido compounds, among which we were able to identify the change of tyrosine and arginine into derived products with simultaneous formation of carbon dioxide. In the chloroformed cheese, the only active proteolytic agents were lactic acid, galactase, and rennet-pepsin. Under the conditions of our experiment, these agents were able to form neither ammonia nor secondary amido compounds with production of carbon dioxide. The presence of chloroform could not account for this lack of action. These results suggest that, in the normal cheese, there must have been some agent at work not present in the chloroformed cheese and that this extra factor was of a biological character. H. W. LAWSON.

Studies on the Digestibility and Nutritive Value of Bread at the University of Minnesota in 1900-1902. BY H. SNYDER. *U. S. Dept. Agr., Office of Experiment Stations Bull. No. 126*, 52 pp.—Two series of digestion experiments with men are reported in detail. The first, which was a continuation of earlier work and included nine experiments, was made with bread from different grades of hard spring wheat flour, and the second, including fifteen experiments, was the beginning of proposed investigations with the products of soft winter wheat. While the protein content of patent flour was somewhat lower than that of entire wheat or Graham flour, the proportion of digestible protein and the available energy was greater than in the coarser grades. There was no marked difference in the digestibility of different grades of patent flour. The results of the experiments with both hard and soft wheat show no increase in the digestibility of flour due to the retention of a large proportion of bran and germ. On account of their tendency to increase peristaltic action the coarser flours are considered especially valuable for some persons.

H. W. LAWSON.

Food Adulteration in Wyoming. BY E. E. SLOSSON. *Wyo. Agr. Expt. Sta. Bull. No. 56*, 34 pp.—The results of examinations of a number of samples of spices, tea, coffee, jams, jellies, canned vegetables, vinegar, and alcoholic liquors are reported, and the new law regulating the sale of foods, beverages, drugs, and illuminating oil, which takes effect September 30, 1903, is appended. Comments are also made on the extent of food adulteration in the state and on the use of preservatives.

H. W. LAWSON.

A Study of Cider Making in France, Germany, and England, with Comments and Comparisons on American Work. By W. B. Alwood. *U. S. Dept. Agr., Bureau of Chem., Bull. No. 71*, 114 pp.—The author describes methods observed in France, Germany and England in the manufacture of cider, including harvesting the fruit, production of must, fermentation, clarification, etc. Analyses of a large number of samples of cider are included and a brief list of references on cider-making is appended.
H. W. Lawson.

American Wines at the Paris Exposition in 1900: Their Chemical Composition and Character. By H. W. Wiley. *U. S. Dept. Agr., Bureau of Chem., Bull. No. 72*, pp. 7–24.—Very complete analyses are reported of nine samples of sparkling wines, two of brandies, fourteen of dry white wines, twenty-two of dry red wines, ten of sweet white wines, and nine of sweet red wines made by wine-makers receiving awards at the Paris Exposition. A large number of the samples conformed to the requirements fixed for Europeans wines. H. W. Lawson.

The Manufacture of Wine in California. By H. Lachman. *U. S. Dept. Agr., Bureau of Chem., Bull. No. 72*, pp. 25–40.—Methods of harvesting, fermentation, clarification, bottling, etc., are described, and a list is given of the varieties of wine produced in California. H. W. Lawson.

Proceedings of the Nineteenth Annual Convention of the Association of Official Agricultural Chemists, Held at Washington, D. C., October 2, 3, and 4, 1902. *U. S. Dept. Agr., Bureau of Chem., Bull. No. 73*, 187 pp.—This is an official account of the proceedings, edited by the secretary of the association, H. W. Wiley. A summarized report of the convention was given in this Journal, R., **8**, 536. A paper by E. Gudeman on "The Determination of Glucose," which was not read at the meeting, and a Memoir of the late R. C. Kedzie, by L. S. Munson, have been included. An excellent portrait of Dr. Kedzie serves as a frontispiece to the bulletin. H. W. Lawson.

PATENTS.

DECEMBER 2, 1902.

714,687. Emile A. Fourneaux, New York, N. Y. Assignor to Herman A. Metz, same place. **Lakes from sulphur dyes.** A solution of a sulphur dye is precipitated by the salt of an earth alkali metal, the precipitate thoroughly washed, dissolved in alkaline liquor and the lake formed by adding a suitable metallic salt as aluminum hydroxide, and the mixture heated till the lake is brightest.

714,748. Henry M. Scott and Hakon Anderson, Sheboygan

Falls, Wis. Composition for **coagulating milk.** Calcium sulphite 75, saltpeter 10, sodium phosphate 10, magnesium phosphate 5 parts.

714,791. George S. and Charles Falkenstein, Philadelphia, Pa. Assignors to Otto Wolff and Alfred D. Wiler, same place. **Artificial leather.** A closely woven textile facing is treated with sulphuric and muriatic acids, an untreated textile backing is applied to the moist side of the facing and the two subjected to heavy pressure, whereby the fabricsare united in one homogeneous sheet.

714,842. Robert F. Wentz, Nazareth, Pa. **Cement making.** The ore is passed through a heat zone with a carbon to form a clinker, which is transferred hot and agitated in an air duct with supply of water whereby hot air and steam are obtained for use in the heating zone.

714,843. **Same as above.** Apparatus to carry out above process, consisting chiefly of a rotating kiln and agitator with deflecting partitions and provided with water and air supply under pressure.

714,849. John F. White, Buffalo, N. Y. Making **soda alum.** Niter cake is dissolved in water and alumina added sufficient to take up the free sulphuric acid, then aluminum sulphate enough to form the double salt, the whole boiled to a syrup, then allowed to cool and harden, then calcined and finished.

714,858. William R. Brixey, Seymour, Conn. **Crude kerite.** Coal tar 25, asphalt 15, linseed oil 70, and sulphur 10 pounds, heated together and vulcanized.

714,850. **Same as above.** Mixing the above compound with natural rubber, and vulcanizing the mixture.

714,880. Carlton Ellis, Brookline, Mass. Composition for **removing paint.** Paraffin and curriers hard grease 4 each, benzene 8, methyl alcohol 7 parts.

714,882. Otto Ernst, Hochst-on-Main, Germany. Assignor to Farbwerke, vorm. Meister, Lucius und Bruning, same place. **Azo dye.** Diazo-*p*-nitraniline orthosulphonic acid is combined with β-naphthol, forming a brick-red powder, difficultly soluble in water, and forming color lakes in the usual way of great fastness.

714,883. As above. **Change yellow azo dye.** Orthonitraniline is used in place of the para-compound.

714,887. Georges L. Flusin, Grenoble, France. Making **smokers' articles.** Brierwood sawdust (100), is mixed with glue (33), porcela inclay (12.5),bauxite (4.)and alkaline silicate (25), with water so as to be fluid, then compressed in a mold and heated to 80° to 120° C., and allowed to dry so as to remove it from the mold.

714,914. Nathan S. Keith, Arlington, N. J. Obtaining **metals.** The ore and gangue are ground together with carbon, the mixture is heated in an open furnace with reducing gas to the melting temperature of the metal only, and mechanically separating and concentrating the metal.

714,931. George Merling, Frankfurt-on-Main, Germany. Assignor to Farbwerke, vorm. Meister, Lucius und Bruning, same place. **Hydrobenzaldehyde.** Hydrobenzylamine bases are oxidized to the corresponding hydrobenzyliden compounds, and these are decomposed by heating with acids to a colorless oil which is a terpene aldehyde with a poignant smell when concentrated but the odor of violets when dilute, miscible with alcohol, ether and benzene and boiling at 90° to 92° C. under 13 mm. pressure.

714,960. Frederic J. Smith, Elizabeth, N. J. Assignor to William H. Bowker, Boston, Mass. A **coated chemical.** A pulverized basic substance each particle coated with a fused salt and subsequently cooled, said salt being soluble in water, and inert when mixed with blue vitriol, nitrogenous matter, potash salts and soluble phosphates. May be caustic lime coated with sodium nitrate.

714,984. Herbert H. Wing, New Brighton, N. Y. **Magnesium sulphate.** Magnesium hydroxide is treated with sulphur dioxide and air, first making magnesium sulphite and sulphate, then continuing the conversion till the change to sulphate is complete, dissolving it in water and crystallizing out the sulphate.

715,016. Herbert W. Butler and Joseph H. May, London, England. Assignors to John Irving Courtenay, same place. **Secondary battery plates.** A paste of lead oxide and powdered carbon is pasted on a grid and oxidized by the current, the plate being attached to the positive pole till oxidized, then the current is passed in the reverse direction to convert the porous peroxide into spongy lead.

715,022. Samuel B. Chroniger. **Plastic compound.** Fire-clay 100, and calcined gypsum ground 200, slaked lime 26, sand 600, and goats hair $^1/_2$ pound.

715,023. John C. Clancy and Luke W. Marsland, New South Wales, Australia. Treating **zinc sulphide ore.** Adds lead sulphate to the ore and roasts at a heat below the volatilizing point of lead, transferring the hot ore to a vat of dilute sulphuric acid, and agitating, recovering the lead sulphate for reuse, conducting the residual ore to a settling vat drawing off the solution, extracting the zinc by alkali and recovering the sulphuric acid, and finally smelting the residue free from zinc for the lead, silver and other metals.

715,024. **Same as above.** Adding lead sulphate to the zinc ore and heating the mixture to convert all volatile metals into fumes.

715,074. Henry S. A. Holt, Ludwigshafen-am-Rhein, Germany. Assignor to Badische Anilin und Soda Fabrik, same place. **Indigo color.** Condenses a halogen indoxyl with halogen indoxyl as brom-indoxyl, forming a blue substance, soluble in cold aniline or carbon disulphide with a blue to green color, and yielding a brown-yellow vat.

715,139. Anthony J. Pilar, Philadelphia, Pa. **Tanning.** The tanning liquid consists of chromium chloride and chromium hyposulphite which are obtained from an aqueous solution of potassium bichromate, hydrochloric acid and sodium hyposulphite.

715,142. Nathaniel P. Pratt, Atlanta, Ga. Making **sulphuric acid.** The uncombined gases are withdrawn from the lead chamber, cooled, and mixed with fresh gases and reintroduced into the acid chamber.

715,186. Charles C. Watkins, Moriah, N. Y. Assignor one-half to Charles Garvey, Crown Point, N. Y. Composition for **golf balls.** Dry powdered peat and yellow ochre 5, crude India rubber 4, and gasoline 16 pounds.

715,211. John M. O'Connor, Port Washington, Wis. Assignor to the Connorite Manufacturing Co., same place. Treating **scrap metal.** A small quantity of lead is added to German silver scrap and heated in a crucible till melted to a homogeneous mass, then a little aluminum is added and the whole poured.

715,213. Alexander W. Playne, Stroud, England. Assignor one-half to Lachlan W. Macdonald, Skye, Scotland. **Indigo vat.** Zinc and sodium bisulphite are boiled with alkali, the clear liquor decanted below the surface of the dye vat, mixing indigo with some of the vat liquor, straining and returning it, and boiling the whole.

715,214. Alexander S. Ramage, Cleveland, Ohio. **Converting lead sulphate to carbonate.** Lead sulphate is treated with an alkali carbonate in excess in solution, the residual liquor is separated and subjected to an excess of lead sulphate to convert the remaining alkali carbonate into sulphate.

715,218. Hugo Strache, Vienna, Austria-Hungary. **Water gas.** A thin layer of fuel is ignited and part of the heat used in heating a regenerator, then a second layer of fuel is added and distilled by the heat of the first layer together with that of the regenerator, while a body of steam is made and led into the regenerator and then through the ignited layers of fuel.

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715,238. Frank L. Bartlett, Canon City, Col. **Refining lead and zinc fume.** A body of the fume is subjected at a low red heat to the action of the products of combustion of carbonaceous fuel, agitating the mixture, and withdrawing the fume into a receptacle where it cools slowly, then separating the outer layer from the body of the mass.

715,311. Martin Van Buren Smith, New York, N. Y. Assignor to American Stoker Co., same place. **Producer gas.** Free air is excluded from a volume of incandescent fuel, beneath which a mass of fresh fuel is fed in with insufficient air for complete combustion, while an additional supply of air is added below the combustion zone of the burning fuel.

715,366. James Gayley, Pittsburg, Pa. **Drying air.** Refrigerates the air to zero centigrade, then brings it into contact with material adapted to absorb water, as $CaCl_2$.

715,462. Franz Daubitz, Rixdorf, and Alfred Loewey, Berlin, Germany. **Molded elastic goods.** Fat oils with 15 per cent. of sulphur chloride are mixed and cast in molds just before solidification.

715,625-6. Girolani Taddei, Turin, Italy. Assignor to Société Italiano di Applicazione Elettriche, same place. **Aluminum by electrolysis.** Decomposes sodium chloride at a high temperature by electrolysis and uses the chlorine to change the oxide of the aluminum to a chloride which is in turn decomposed by the sodium of the first operation. The alumina is mixed with a carbonaceous substance, and the aluminum chloride and sodium are both in a state of vapor. The second patent is for apparatus.

715,662. Max H. Isler, Mannheim, Germany. Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-am-Rhein, Germany. **Anthracene dye.** Methyl anthraquinone is nitrated and then reduced to an alphyl-amino compound, the latter transformed into a halogen derivative and this condensed with an aromatic amine, and finally sulphonated. The dye is soluble in water blue, in concentrated sulphuric acid violet, and dyes unmordanted wool blue to green shades.

715,680. George W. Meiser, Ludwigshafen-am-Rhine, Germany. Assignor to Badische Anilin und Soda Fabrik, same place. **Aromatic amido fatty compound.** α-Aminoacetonitrile is treated with aniline, whereby ethyl anilidoacetonitrile is formed in colorless crystals that distil *in vacuo* at 180° C. and on treatment with concentrated sulphuric acid form an amide melting at 114° C.

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715,748. Paul Boessneck, Glauchau, Germany. **Acetic acid.** A mixture of calcium pyrolignite and hydrochloric acid is fed continuously into the top of a coffee still while steam is supplied to the bottom, thus establishing counter currents of steam and the mixture, the acetic acid being taken up by the steam.

715,751. John W. Brown, Newburyport, Mass. Assignor to George M. Port, Boston, Mass. **Leather varnish.** Asphaltum 2, linseed oil 5, gum anime 3, and turpentine as required.

715,763. Thomas H. Denny, Cape Charles, Va. Assignor to Leonard J. Whitehead and James B. Jones, same place, and

Josephus F. Bussells, Irvington, Va. **Antifouling paint.** Mercury 17, tallow 25, ocher 128, linseed oil 60, Japan drier 15, and red lead 25 pounds.

715,771. Francis Ellershausen and Richard W. Western, London, England. Treating **zinc ores.** Hydrogen ammonium sulphate is made to react on zinc ore to form double sulphate of ammonium and zinc; the ammonium sulphate is agitated with slaked lime and ammonia recovered and drawn off, and added to the double ammonium and zinc sulphate previously made to precipitate the zinc. Any cadmium in the ore is precipitated with zinc.

715,778. Hans A. Frasch, New York, N. Y. **Concentrating gases.** SO_2 is cooled by direct contact with water, and absorbed under pressure in a solution already saturated with SO_2 at atmospheric pressure, and which is washed with cold water, the pressure released and the surcharged SO_2 evaporated and the liquid reused.

715,784. Lewis C. Grant, Cleveland, Ohio, and Nelson B. Chester, Caldwell, N. J. **Puncture healing compound.** Asbestos 9, borax 1, mica 4, and granulated cork 2 parts.

715,798. John A. Heany, Philadelphia, Pa. Assignor to the Teter Heany Developing Co., same place. **Insulating compound** consists of asbestos, cemented on by the following compound: lime 16, borax 4, alumina 6, kaolin 6, and alumina sulphate 32 parts, and glue as required.

715,804. Henry E. Howard and George Hadley, Birmingham, England. Treating **spent acid from galvanizing works.** Adds zinc to liquor, removes the precipitate, adds bleaching-powder to change ferrous to ferric compounds, then alkali to throw down iron salts as ferric hydroxide, which is removed, then more alkali to precipitate the zinc.

715,844. Oliver M. Nash, East Pepperell, Mass. **Laundry gloss.** Japan wax 4, paraffin 3, stearic acid 2 pounds, oil of lavender and sassafras each 30 drops, glycerol 2 ounces.

715,896. Adolph Strebel, Frankfurt-on-Main, Germany. Assignor to Haarman and Reimer, Holzminden, Germany. **Ionone.** Cyanacetic acid is caused to react on citral in the presence of alkali, producing citralidenacetic acid, which is converted into the cyclic isomeride, by concentrated acids; the cyclocitral is separated, dissolved in alkaline alcohol, and the ionone distilled off. The cyclocitral is a yellowish liquid boiling at 60° to 110° at 12 mm. of pressure.

715,928. Gabriel Youngwitz, New York, N. Y. **Imitation leather.** Coats a suitable material with a composition of lampblack and linseed oil 10 parts each, naphtha 12 parts, dries and gives two more coats (using blacking in place of lampblack), then varnishes.

716,008. Alfred Dorsemagen, Wesel, Germany. Working substances containing zinc and silicic acid in **electric furnaces.** The charge is prepared of zinc silicate and carbon, the current must reduce and volatilize the zinc and form silicon carbide, and the products of volatilization and reduction are condensed.

716,083. Milton McWhorter, San Francisco, Cal. Assignor to James Uhler Hastings, *et al.*, same place. **Tire-repairing compound.** Asphaltic petroleum is distilled at 350° F., crude rubber is dissolved in carbon disulphide and the asphalt added, the carbon disulphide is distilled off from the mixture and a little oil of sassafras added.

716,084. Oscar Nastvogel, Elberfeld, Germany. Assignor to the Elberfeld Co., New York, N. Y. **Acridine dye.** Formic acid is caused to react on the free base of acridine yellow and the dye isolated in the form of a yellow-brown powder soluble in water and alcohol yellow with green fluorescence, soluble in concentrated sulphuric acid yellow, turning red-brown with ice, splitting off formic acid on heating with sulphuric acid, and dyeing green-yellow shades on tannin mordants.

716,106. Rudolph Rickmann, Kalk, near Cologne, Germany. **White enamels.** Fuses sodium antimoniate with the enamel.

716,132. John S. Stewart Wallace, Knock, Ireland, and Wm. B. Cowell, London, England, said Cowell assignor to Wallace. **Refining mineral oils.** Mixes with water and adds solutions of caustic soda, potassium permanganate and aluminum sulphate at 180° to 212° F., agitating while heating, condensing light oils driven off, settling the mixture and finally distilling.

716,182. Charles S. Bradley, Avon, N. Y., Robert H. Read, and Charles B. Jacobs. Assignors to Ampere Chemical Co., East Orange, N. J. **Carbophosphide of calcium.** Calcium phosphate, lime and carbon are fused into a crystalline mass, spontaneously inflammable in water.

716,242. Paul Julius, Ludwigshafen-am-Rhein. Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-am-Rhein, Germany. **Disazo dye.** *p*-Chlorsalicylic acid is treated successively with nitric acid, sodium bisulphite and nitrous acid, and the resulting *o*-diazo-*p*-chlorsalicylic acid is combined with Cleves α-naphthylamine sulpho acid, diazotizing and combining with β-naphthol. The dye is soluble in water red-violet, unchanged by sodium carbonate in small amount but precipitated by it in excess or by HCl, dissolving blue in caustic soda and dark blue in concentrated sulphuric acid, dyeing black with bichromate.

716,248. Rudolph Knietsch and Maximilian Scharff, Ludwigshafen-am-Rhein, Germany. Assignors to Badische Anilin und Soda Fabrik, same place. **Sulphuryl chloride.** Chlorine and sulphur dioxide are mixed in a liquid state with camphor.

716,264. Carl L. Miller and Ernst Schmid, Ludwigshafen-am-Rhein, Germany. Assignors to Badische Anilin und Soda Fabrik, same place. **Acridine dye.** Phthalic anhydride is melted at 170° to 220° C. with a meta diamine and a condensing agent as zinc chloride. The dye dissolves in alcohol or water yellow with green fluorescence, and decomposes on boiling with concentrated hydrochloric acid.

716,276. Alonzo Ramsdell, Chicago, Ill. **Alloy.** Cast iron is melted, cooled to a red heat, then nine to fifteen ounces of lead to each hundred pounds of iron are added and mixed.

716,289. Conrad Schraube, Erhart Schleicher, and Hans T. Bucherer, Ludwigshafen-am-Rhein, Germany. Assignor to Badische Anilin und Soda Fabrik, same place. **Azo dye.** The primary disazo dye obtained by combining in acid solution 1-8-aminonaphthol-4-sulpho acid with diazotized aniline, then adding diazotized sulphurous acid ester of 1-8-aminonaphthol in alkaline solution. It is not decomposed by dilute sulphuric acid in the cold, but decomposed after boiling with an excess of sodium carbonate, soluble in water violet, precipitating with sodium carbonate which precipitate dissolves on boiling, dyeing wool black that greens on treatment with copper acetate.

716,318. Alfred G. Wass, London, England. **Varnish.** Mineral oil, specific gravity 0.880, 18 parts, rosin 20 parts and color to suit.

716,350. Fritz Roessler, Frankfurt-on-Main, Germany. Assignor to Roessler and Hasslacher Chemical Co., New York, N. Y. **Sodium cyanide.** Gases containing hydrocyanic acid are passed through concentrated caustic soda at a temperature above 33° C.

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716,371. William Black and Harry S. Richards, Chicago, Ill. Finishing **artificial stone.** The surface of the finished stone is treated with muriatic acid, then rinsed in water, then subjected to a solution of sodium carbonate, and finally again rinsed in water.

716,381. Thomas A. Clayton, New York, N. Y. Apparatus for **charging gas.** A generating furnace with air supply and delivery conduit leading to the charging chamber in connection with a regulable gas escape and circulating pipe containing a cooling device and means for producing complete circulation as required.

716,396. Arthur Eichengrün, Elberfeld, Germany. Assignor to Elberfeld Co., New York, N. Y. **Photographic developer.** A developing bath containing acetone alkali bisulphite of the formula $(CH_3)_2COHSO_3M$, M denoting an alkaline metal as potassium or sodium.

716,455. Leonard L. Merrifield, Toronto, Canada. Assignor to Economical Gas Apparatus Construction Co., same place. **Gas from peat.** The material is fed to a pair of producers the lower

part of which is raised to incandescence, which vaporizes the moisture in the upper part, and the gas and steam are drawn off from between the fresh and incandescent fuel and sent through the incandescent fuel in the second producer; then the operation is reversed.

716,491. Stewart J. Spence, Harriman, Tenn. **Dentists' cement.** Plaster of Paris $10^3/_4$, Portland cement $3^3/_4$ and $1^1/_2$, alum $^1/_6$, citric acid $^1/_{80}$ parts.

716,558. Jean M. A. Lacomme, Brooklyn, N. Y. Assignor to Walter Lauder, Brooklyn, N. Y., and James L. Hackett, Louisville, Ky. **Preserving fruits.** Air is passed through ozonized oxygenated and antiseptic liquid, subjected to an electric current, then charged with ozone by an induction coil, and with X-rays, and passed into the treating chamber containing the fruit, which is afterwards treated with steam and covered with an antiseptic coating.

716,559. Gerald W. Laybourne, Stoke-on-Trent, England. **Depositing metals on earthenware.** The body is fired in a gradually increasing temperature and soaked in the heat, then steeped in water, coated with a conducting medium and electroplated.

716,567. Hugo Mock, St. Paul, Minnesota. Assignor to Wm. A. Albrecht and Arthur C. Davenport, same place. **Ink eradicator.** Dissolve 8 parts bleaching-powder with 3 of sodium carbonate, forming sodium hypochlorite, sodium chloride and calcium carbonate, add magnesium carbonate 8 parts, and water to a paste.

716,591. Samuel L. Summers, Philadelphia, Pa. **Alkali salts of methylene disalicylic acid.** Aqueous alkali is caused to react on methylene disalicylic acid, and the solution is evaporated to dryness. It is an amorphous powder, nearly white, soluble in water and alcohol, insoluble in benzene and ether, and has the formula $C_{15}H_{10}O_6(R')_2$ in which R is a univalent alkali.

716,592-3 are **as above** for alkaline earth salts, insoluble in water and alcohol, and metallic salts proper insoluble in water (hot or cold), and made by a corresponding process.

716,660. Guido Blenig, New York, N. Y. **Fireproofing wood.** Alum and potash 1 each, liquid glass 2, whiting 4, and water 16 parts.

716,678. Alonzo P. Cuthriell, Portsmouth, Va. **Coating for ships' bottoms.** Oxides of zinc 4, and of iron 11, linseed oil 20, shellac varnish 60, and oil of pine tar 20 parts for the first coat, and a second coat of Venetian red 10, varnish 30, linseed oil 3, arsenious acid 1, and mercuric oxide 3 pounds.

726,689. Herbert W. C. K. Dyson, London, England. **Red artificial stone.** Sand is treated with a solution of ferric sulphate, then heated to produce the proper color for use in making the stone.

716,776. Leopold Spiegel, Berlin, Germany. Assignor to Chemische Fabrik Guestrow, Guestrow, Germany. **Salt of Yohimbine.** Yohimbine chloride consists of minute white needles, melting at about 300° C. and corresponding to the formula $C_{22}H_{28}O_3N_2HCl$.

716,778. Charles H. Stearn, London, England. **Cellulose filaments.** Viscose (cellulose xanthogenate) is aged in solution by standing, then dissolved in an alkaline solution, which is expressed in filament form in a setting solution of ammonium sulphate, thereby gelatinizing the viscose, and decomposing it after spinning.

716,787. Robert M. Thomson, Sutton, Neb. **Wurtzilite product.** Wurtzilite (an asphaltic mineral) is combined with a hardening substance as mica, asbestos or soapstone and sulphur.

716,789. Richard Threlfall, Birmingham, England. Making **chlorates.** Chlorates and perchlorates are obtained by dividing the electric current and forming an alkaline solution in one vessel and the corresponding amount of chlorine in the main electrolyte in a separate vessel.

716,803. Edward Zahm and John A. Just, Syracuse, N. Y. **Purifying gas.** The gas is forced through a hollow core of porous purifying material, immersed in an antiseptic or purifying liquid, whereby the gas is finely broken up and brought into intimate contact with the liquid.

716,804. Edward A. Allen, Rumford Falls, Me., and Hugh E. Moore, Lynn, Mass. Assignor to Moore Electrolytic Co., Boston, Mass. Apparatus for making **caustic soda by electrolysis.** A suitable tank is provided with vertical porous diaphragms, considerable liquid, an anode, and a cathode in contact with the outer face of the diaphragm, said cathode being formed of a thick layer of porous material adapted to hold much liquid, whereby the sodium deposited is hydrated in the cathode and the electrolyzing of the undecomposed solution in the cathode is completed as it flows through from side to side.

716,847. Frederick W. Martino, Sheffield, England. Obtaining **precious metals.** Gold ores containing Te, Se, S, As, Sb, Sn or phosphorus are ground, heated with barium sulphocarbide in powder in a reducing furnace, dissolving out the soluble sulphides thus formed, treating the solid residue with a gold solvent and precipitating the gold therefrom by the use of barium sulphocarbide.

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716,878. Benjamin R. Faunce, Philadelphia, Pa. Making **caffein.** The deposit on the inside of the flues and pipes of coffee roasters is collected, distilled and the vapors condensed, the condensate boiled in water to separate the oil, and the resi-

due also boiled and filtered, the two solutions united, the caffeïn crystallized by evaporation and further purified by recrystallization or sublimation.

716,894. Alfred M. Hewlett, Kewanee, Ill. **Annealing steel castings.** A sufficiently large mass of the castings are put in the annealing furnace and heated up to annealing temperature, then left to cool, the mass being so large as to maintain heat the required time.

716,977. Edward L. Anderson, St. Louis, Mo. Assignor to John A. Gilliam, Trustee, same place. **Purifying aluminum.** The surface is treated with hydrofluoric acid and the gas formed rapidly removed by chromic acid or other hydrogen absorbent.

716,985. Adolph Clemm, Mannheim, Germany, **Sulphuric anhydride.** Unburnt moistened clay is mixed with copper sulphate and dried, then heated to a red heat and used as contact material for a mixture of dry sulphurous acid and air.

716,994. Max Engelmann, Elberfeld, Germany. Assignor to Elberfeld Co., New York. **Theophyllin.** Alkalies are made to react on the mono formyl derivative of 1-3-dimethyl-4-5-diamino-2-6-dioxypyrimidine, then decomposing the alkaline theophyllin salts thus obtained by acids.

717,016. Ralph H. Page, Detroit, Mich. **Organic peroxide.** An aqueous solution of hydrolyzed acetyl peroxide obtained by dissolving benzoyl acetyl peroxide in water, whereby acetic acid, dibenzoyl peroxide, and acetyl hydrogen peroxide are formed. The latter substance may also be made by the hydrolysis of diacetyl peroxide.

717,050. John W. Strehli, Cincinnati, Ohio. **Molded fibrous articles.** The fiber is first treated with zinc chloride, then dried, then mixed with a binding agent as resin and pulverized lime, and finally molded under heat and pressure.

717,066. Walter B. Bishop, Alfred Bishop, and Frances W. Passmore, London, England, said Passmore assignor to the others. **Piperidine salt.** One part of piperidine is caused to react on two parts of *p*-sulphaminobenzoic acid in aqueous solution with heat enough to effect solution, and crystallized out as a white powder melting at 228° C. and having the formula $C_6H_4SO_2NH_2COOHC_5H_{11}N$.

717,085. Henry V. Dunham, New York, N. Y. Assignor to Casein Co. of America, same place. **Casein compound.** Dry caseïn 100, powdered borax 15, and potassium oxalate 2 parts.

717,107-8. William Morrison, Chicago, Ill. Assignor to King Upton, same place. **Secondary battery.** A paste of lead oxide and hydrofluoric acid forms one element in the first, and the second uses an electrolyte containing fluorine.

WM. H. SEAMAN.

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GEOLOGICAL AND MINERALOGICAL CHEMISTRY.

The Geological Features of the Gold Production of North America. BY WALDEMAR LINDGREN. *Trans. Am. Inst. Min. Eng.* (*Advance extra, New Haven Meeting, October, 1902, 56 pp.*). —Notwithstanding its lack of chemical data, this paper is entitled to mention in this review. Its purpose "is briefly to consider the product of each state in North America, emphasizing especially the derivation of the gold from its various classes of deposits, so as to arrive, if possible, at an approximate conclusion as to the relative importance of the different kinds of deposits, and finally to indicate the probable outlook in each state for the immediate future." The following table gives the author's estimate of the source of production of gold in North America, the figures representing millions of dollars:

	Total.	1900.
Pre-Cambrian	139	5
Cretaceous (Pacific)	1719	54
Cretaceous and early Tertiary (Central)	287	14
Tertiary (largely propylitic)	724	43
	2869	116

W. F. HILLEBRAND.

The Geographical and Geological Distribution of the Mineral Deposits of Mexico. BY JOSE G. AGUILERA. *Trans. Am. Inst. Min. Eng.* (*Advance extra, Mexican Meeting, November, 1901, 24 pp.*). W. F. HILLEBRAND.

Ore-Deposition and Vein-Enrichment by Ascending Hot Waters. BY W. H. WEED. *Trans. Am. Inst. Min. Eng.* (*Advance extra, New Haven Meeting, October, 1902, 8 pp.*).—Not only, as is quite generally admitted, can enrichment of mineral veins be brought about by descending waters which have derived their metallic contents from the upper portions of the vein,

but, according to the author, by a reopening of the primary vein, as a consequence of earth movements, and subsequent flow of hot waters from deep-seated sources toward the surface. These waters may be acid or alkaline and the results of their action upon the already existing vein-contents will differ accordingly. In an unfilled fissure, the ascending hot waters, "if metalliferous, may deposit ores with an orderly vertical distribution," as is often actually observed. "Ascending, hot, *alkaline* waters coming up through crushed and reopened veins containing pyrite (or marcasite) react with the sulphide, and zinc, lead, copper, or silver, if present, are thrown down as sulphides. Ascending, hot, *acid* waters may reach the lower levels of reopened veins and deposit gold, silver and copper upon cooling at higher levels." The conclusions reached are largely due to recent important work by Dr. H. N. Stokes in the laboratory of the Geological Survey, as yet unpublished, except for brief quotations in the present papers. From these it is seen that hot alkali-carbonate solutions act upon pyrite with formation of alkali sulphide and thiosulphate and oxidation of the iron. The reaction is reversible, but if the soluble sulphide is removed as fast as formed, complete oxidation of the pyrite results. If the removal of the sulphide is accomplished by a heavy metal carbonate, as of lead, copper, silver, the corresponding sulphide is precipitated. Since in these reactions carbon dioxide is formed, and this partially decomposes soluble sulphides with formation of hydrogen sulphide, "by heating FeS_2 with $KHCO_3$ solution in a sealed vessel filled with CO_2 and so arranged that the volatilized H_2S is continually taken up by an absorbent, it was found possible to convert FeS_2 completely into hematite, without direct contact with metallic salts and in absence of oxygen." Hence, Dr. Stokes concludes: "That the conversion of FeS_2 into Fe_2O_3 is not a necessary proof of the action of oxidizing (descending) waters, but may be due to any alkaline solution free from oxygen," and that "the circulating solutions which have acted on FeS_2 may carry away alkaline sulphide, and cause the deposition of other sulphides, as of copper, zinc, lead, silver, at another place."

W. F. HILLEBRAND.

Ore-Deposits Near Igneous Contacts. BY W. H. WEED. *Trans. Am. Inst. Min. Eng. (Advance extra, New Haven Meeting, October, 1902, 32 pp.).*—This paper "is largely a discussion of contact metamorphic ore-deposits based upon the physical changes in rocks due to contact action." Its only strictly novel feature is the discussion of the origin and character of that class of contact deposits which is due to the porosity induced in certain sedimentary rocks by contact metamorphism. The author's conclusions are: "Contact metamorphic ore-deposits occur about the margin of intrusive masses of granular, igneous rocks, either at the actual contact or in the zone of metamorphosed sedimentaries. The deposits of economic value occur only where strata or blocks

of impure limestone have been crystallized as garnetiferous or actinolite-calcite rocks, with consequent porosity . . . The ore-minerals were introduced in gases and vapors—solfataric emanations—from the eruptive masses of which they constitute pneumatolytic after-actions, or by hot, circulating, primitive waters given off by the cooling igneous mass. This theory of genesis being true, the deposits should extend downward in depth to the granular rock." The author holds the view, in opposition to van Hise, that the ore-forming solutions of certain veins cutting the igneous rock and the contact-rocks above them were not of meteoric but of direct igneous origin.

W. F. HILLEBRAND.

Zinc and Lead Deposits of Northern Arkansas. BY GEORGE I. ADAMS. *Trans. Am. Inst. Min. Eng.* (*Advance extra, Albany Meeting, February, 1903, 12 pp.*).—A preliminary statement of results and conclusions from an extensive report now in preparation for the U. S. Geological Survey. It is sufficient to say, at present, that the author's views are by no means altogether in agreement with those of earlier workers in this region. (See this Review, **24**, R. 206, and **25**, R. 166).

W. F. HILLEBRAND.

Some Practical Suggestions Concerning the Genesis of Ore-Deposits. BY MAX BOEHMER. *Trans. Am. Inst. Min. Eng.* (*Advance extra, British Columbia Meeting, July, 1903, 6 pp.*). —The author finds it difficult to accept the theory that ore deposits may owe their origin solely to the circulation of meteoric waters. " . . it fails to explain the localization of the deposits, depreciates the importance of the eruptive rocks, and does not convince us that the waters feeding the springs of the earth are the same which have deposited the millions of tons of ore in the great mining districts." He accepts the existence of "an underground sea of water, continuous and saturating the rocks throughout," and attempts "to show that the waters in the zone of open fracture in the upper region do not search or leach the masses of rock, but that they flow through them in permanent and open channels; that the waters in the middle and lower zones of the underground sea are stagnant and not sufficiently effective; and that we must look still deeper for the source that could supply the immense masses of ore found in the veins."

W. F. HILLEBRAND.

The Synthesis of Chalcocite and its Genesis at Butte. BY HORACE V. WINCHELL. *Eng. Min. J.*, **75**, 782–784.—The author supposes chalcocite, Cu_2S, the chief copper mineral in the mines at Butte, Montana, to have been formed by the action on pyrite or other sulphides of descending acid waters carrying cupric sulphate. In order to explain this formation instead of that of CuS, it is supposed that SO_2, formed from the oxidation

of pyrite, reduces some of the cupric ions to the cuprous state, these being then precipitated as sulphide by interchange with other metallic sulphides. Experiments were made showing the actual deposition of chalcocite by pyrite and other sulphides from cupric sulphate solutions charged with sulphurous acid, but some of the statements are so confused and even contradictory that it is difficult to decide what weight should be given the experimental data. W. F. HILLEBRAND.

The Monteregian Hills—A Canadian Petrographical Province. BY FRANK D. ADAMS. *J. Geol.*, 11, 239–282; maps and figures. —The author gives the above name to the succession of prominent hills, beginning with Mount Royal (Montreal) and extending in an easterly direction for about fifty miles, that are such pronounced landmarks in the valley of the St. Lawrence. The eight hills, Royal, Montarville, Beloeil, Rougemont, Yamaska, Shefford, Brome, and Johnson, he finds constitute a well-defined petrographical province. The rocks of other hills, such as Rigaud, Calvaire, etc., which have been supposed to belong to this group, are now known to be of different character. Shefford and Brome have already been described, and Beloeil is under study. The present paper is chiefly taken up with a study of the rocks of Mount Johnson, but the petrography of the whole group, so far as revealed, is considered. The rocks forming the great intrusions making up the mass of these hills are of two well-characterized types: 1. Alkali syenite, nepheline syenite, or sodalite syenite; 2. Essexite. They afford most excellent examples of magmatic differentiation. In addition, dykes are very numerous; their rocks will be separately studied.

Mount Johnson, a volcanic neck of the most typical form, "consists of essexite in the center, surrounded by a zone of pulaskite, the two rocks passing imperceptibly into one another." Probably the same relation obtains at Beloeil, showing but a single period of intrusion, whereas at Mounts Royal and Shefford the essexite represents the earliest intrusion. Careful analyses of Mount Johnson rocks are given, in part by Professor Norton-Evans, in part by Mr. M. F. Connor, which permitted of very exact classification by the new system (this Review 25, 7), as follows: I. Normal essexite (andose); II. Olivine-bearing essexite (essexose); III. Transition rock from essexite to pulaskite; IV. Pulaskite (laurvikose); V. Hornblende from the essexite.

	I.	II.	III.	IV.	V.
SiO_2	48.85	48.69	50.40	57.44	38.633
TiO_2	2.47	2.71	1.17	1.97	5.035
Al_2O_3	19.38	17.91	....	19.43	11.974
Fe_2O_3	4.29	3.09	5.58 (as FeO)	1.69	3.903
FeO	4.94	6.41		2.70	11.523
NiO,CoO	not det.	0.05	not det.	....	....
MnO	0.19	0.15	0.77	0.25	0.729

	I.	II.	III.	IV.	V.
MgO	2.00	3.06	....	1.16	10.200
CaO	7.98	7 30	6.77	2.66	12.807
BaO	....	0.08	....	not det.	....
Na_2O	5.44	5.95	6.24	6.48	3.139
K_2O	1.91	2.56	2.56	4 28	1.489
P_2O_5	1.23	1.11	0.09	0.60	....
Cl	not det.	not det.	....	trace	....
H_2O	0.68	0.95	....	0.59	0.330
	99.36	100.02		99.69	99.762

The positions of the earlier analyzed rocks from Shefford (*Am. Geologist*, **28**, 203, this Review, **24**, R. 6) have been calculated, the essexite becoming akerose, and the nordmarkite, nordmarkose.

W. F. HILLEBRAND.

Preliminary Report on the Lead and Zinc Deposits of Southwestern Wisconsin. BY ULYSSES SHERMAN GRANT. *Wisconsin Geol. and Nat. Hist. Survey, Bull. No. IX*, 103 pp., maps and figures.—This report brings the geology, particularly of the ore deposits, down to the present time, there having been no complete discussion of the district since Chamberlin's report of twenty years ago, and gives the present and future outlook for mining, which the author regards as very promising. Of the few analyses in the book, only one seems to be new, that of portions of the Galena limestone free from flint nodules, by Prof. W. W. Daniels, which shows: $CaCO_3$, 54.33; $MgCO_3$, 41.56; Fe_2O_3, 0.90; Al_2O_3, 0.99; SiO_2, 2.10. Total, 99.88.

W. F. HILLEBRAND.

Analyses of Certain Clays Used for Making Paving Brick for Cedar Rapids, Iowa. BY C. O. BATES. *Proc. Iowa Acad. Sci. for 1901*, pp. 61–63.—A table of analyses made several years ago, with descriptions of the clays.

W. F. HILLEBRAND.

A New (?) Meteoric Iron from Augusta County, Virginia. BY H. D. CAMPBELL AND JAS. LEWIS HOWE. *Am. J. Sci.*, **15**, 469–471; figure. This is a partial description of a meteorite, which has been in the mineral collection of the Washington and Lee University, Lexington, Va., since 1870 or 1871. Analysis by J. E. Whitfield shows: Fe, 89.850; Ni, 7.560; Co, 0.600; Cu, 0.065; P, 0.158; S, 0.006; C, 0.046; Si, 0.045; oxide, 1.560. The gases were extracted and analyzed by Professor Ramsay and found to consist of methane in the main, with considerable hydrogen, a little argon, and possibly a trace of helium. Comparison of the results with older analyses of the Staunton irons, of which several have been made, and which yielded helium in one case, does not permit of settling the question of the identity of the present iron with those known as "Staunton." The prominent club-shaped, kamacite blades of all but one of the latter

are here absent, and there are perhaps structural differences. The meteorite will be known as "Staunton No. 7." Its present weight is 6.04 kilograms. W. F. HILLEBRAND.

Meteorite from Algoma, Wisconsin. BY WILLIAM HERBERT HOBBS. *Bull. Geol. Soc. Am.*, *Vol. 14*, pp. 97–116, plates and figures. This is a markedly discoid meteorite, an octahedral siderite, found in 1887, and now weighing nearly 4 kilograms. It is rich in kamacite and taenite, and poor in plessite. It "belongs to the Charlotte group and is in many respects similar to Cohen's Charlotte type." Closely agreeing analyses by Arthur A. Koch are reported, of which the following is the mean: Fe, 88.62; Ni, 10.63; Co, 0.84; P, 0.15; Si, 0.02; S, trace; Cu and C, absent; total, 100.26. Specific gravity, 7.75. The markings are discussed at length, also the probable manner of flight through the air, and there is an appendix by Chas. S. Schlichter on the motions of a discoid meteorite. W. F. HILLEBRAND.

Synopsis of Paper on the Development of Pseudomorphs. BY HORACE B. PATTON. *Proc. Colo. Sci. Soc.*, 7, 103–108; plates.—The author presents nothing new, but illustrates some of the processes producing pseudomorphs by unusually fine material, particularly of dolomite encrusting calcite from the Camp Bird Extension mine, Ouray, Colorado.

W. F. HILLEBRAND.

Lime and Cement Industries of New York. BY HENRICH RIES, with chapters on the Cement Industry in New York, by Edwin C. Eckel. *Bull. New York State Mus. No.* **44**, Vol. 8, pp. 637–968.—This voluminous report, abounding in plates and analyses, treats not only of the occurrences of the state, but deals also with the numerous industrial uses of limestones except for building and road construction, and contains a fund of useful information. There is an extended table of physical tests made by the state engineer during 1897–1900, and, in addition to the analyses of New York limestones scattered through the text, there is a table of analyses at the end of no less than 880 limestones grouped by states, the use of which is greatly aided by a key to the series, based on composition.

W. F. HILLEBRAND.

Plumasite, an Oligoclase-Corundum Rock Near Spanish Peak, California. BY ANDREW C. LAWSON. *Bull. Dept. Geol., Univ. California, Vol. 3*, No. 8, pp. 219–229.—Corundum has only within the past five or six years been recognized as an essential constituent of igneous rocks, but within that period a number of occurrences have been noted, of which this is the latest. The plumasite occurs as a dyke of limited extent cutting a broad belt of peridotite. This latter Dr. Blasdale analyzed with the following results: SiO_2, 41.49; Al_2O_3, 2.22; Fe_2O_3, 1.07; FeO, 7.11; MgO,

39.63; CaO, 1.89; ign., 5.56; total, 98.97; from which its mineral composition is computed to be: Olivine, 44.97; serpentine, 33.12; magnetite, 1.39; edenite, 19.60; total, 99.08. The edenite is original, and not secondary, as Turner concluded from his observations elsewhere on the belt. The white dyke rock (sp. gr. 2.633) is composed almost wholly of oligoclase and corundum in about the proportion 84 : 16. The composition of the feldspar as ascertained by J. Newfield is: SiO_2, 61.36; Al_2O_3, 22.97; CaO, 5.38; Na_2O, 8.08; H_2O, 1.72; total, 99.51. The corundum crystals range in length from a few millimeters to over 5 cm. Plumasite "may be defined as a rock resulting from the consolidation of a magma having the composition of a medium acid plagioclase with an excess of alumina."

W. F. HILLEBRAND.

Annual Report of the Minister of Mines [British Columbia] for 1901. 1236+xviii pp.—Scattered through the series of reports making up this volume are occasional analyses of coals, ores, and waters.

W. F. HILLEBRAND.

Precious Stones in 1902. *Eng. Min. J.*, March 7, 1903 (from *Bull. U. S. Geol. Surv.*). BY G. F. KUNZ.—This year has seen the finding of a new locality for sapphires in Montana, the developing of old beryl localities in Mitchell County, N. C., and at Grafton, N. H., the opening of an amethyst mine in South Carolina and of two in Virginia, the discovery of a new deposit of rubellite near Banner, Cal., the further development of chrysophrase in Tulare Co., Cal., and the discovery of a new locality in Buncombe Co., N. C., the increase of turquoise production in Arizona and discovery of that gem in two localities in Alabama. The total value was $318,300, the principal items being sapphire, $115,000; turquoise, $130,000; tourmaline, $15,000; quartz, $12,000; chrysoprase, $10,000; silicified wood, $7,000.

J. W. RICHARDS.

METALLURGICAL CHEMISTRY.

The Hearst Memorial Mining Building, University of California. BY S. B. CHRISTY. *Eng. Min. J.*, March 21, 1903.—A detailed description of the building devoted exclusively to mining and metallurgy; apparently one of the largest, finest and best-equipped laboratories of the kind in the world. The large provision for practical work, roasting, smelting, machinery, etc., suggests rather the manual training school and commercial testing laboratory, than a university laboratory; but facilities for instruction and research are not lacking, and the combination is probably that best adapted to the needs of such a rapidly developing country.

J. W. RICHARDS.

Protecting Furnaces with Carborundum. *Iron and Mach.*

World, March 21, 1903.—A thin layer of carborundum applied to the surface of an ordinary, refractory, furnace lining protects it from all ordinary corrosion. The fine powder is made into a paste with water-glass or a similar binding substance and applied by a brush, either to the bricks before putting into the furnace or after the furnace is built. A layer 2 mm. thick is stated to be sufficient to withstand any temperature produced by combustion in ordinary furnaces. J. W. RICHARDS.

The Smelting of Iron Ores and the Production of Steel in the Electric Furnace. BY M. RUTHENBURG. *Electrochemical Industry*, February, 1903.—Rossi, at Niagara Falls, claims to be able to produce one ton of iron by using 4,800 electric horse-power hours; DeLaval, in Sweden, calls for 3,500, Stassano claims to have done it with 3,000. A recording wattmeter is the only proper instrument for determining these quantities satisfactorily. The writer claims to have done it with 500 horse-power hours, requiring the burning of 1,000 pounds of soft coal. The ore is mixed with enough carbon to reduce it, and passed between two rolls, which it bridges over electrically, receiving a current of 700 amperes at 50 volts pressure. This frits it together, and it falls into a soaking pit, highly heated and minus most of its oxygen. In the soaking box the reduction completes itself, and the reduced material is melted down in an open-hearth furnace. Two photographs are shown. J. W. RICHARDS.

Production of Bessemer Steel in 1902. *Iron Age*, March 12, 1903 (from *Bull. Am. Iron and Steel Association*).—The output in the United States was 9,306,471 gross tons. This was all from ordinary acid converters, excepting two Roberts-Bessemer plants, five Tropenas plants and one Bookwalter converter,—all these running on small castings. Of the total output, 2,876,293 gross tons, or 30 per cent., were rolled into rails.

J. W. RICHARDS.

Melting Steel with Cast Iron. BY R. P. CUNNINGHAM. *Iron Age*, March 19, 1903. (Read before the New England Foundrymen's Association.)—Melting a certain percentage of soft steel with cast iron is a simple, safe, and sure means of increasing tensile strength in the castings. For a heat of 4000 pounds, it is recommended to use 25 per cent. of steel. A high percentage of steel increases shrinkage and demands purer pig iron. For thin castings, only a small percentage can be used; more is permissible in heavy castings, which have a self-annealing power as they slowly cool. It is better to use pig iron high in manganese and silicon than to add much ferromanganese or ferrosilicon in the ladle, since the latter often does not get thoroughly mixed with the metal. Analyses and tests of the so-called "semi-steel" produced, however, do not show any variation either in composition or properties from good quality cast iron. J. W. RICHARDS.

Effect of Titanium on Steel. By A. T. Rossi. *Eng. Min. J.*, March 7, 1903. (Paper read before *Am. Inst. Mining Eng.*)—In crucible steels containing 1.25 to 2 per cent. carbon, 0.10 per per cent. titanium has a marked effect, and 0.89 to 1.01 per cent. a considerable effect in increasing ductility, as shown by increase of elastic limit, elongation and contraction of area. The use of titanium in open-hearth and Bessemer steel is recommended as not only deoxidizing the metal but also as combining with and removing nitrogen. J. W. Richards.

The Use of Carbide of Silicon. *Eng. Min. J.*, March 28, 1903 (from *Cleveland Iron Trade Review*).—Silicon carbide or carborundum is being employed to some extent as a substitute for ferrosilicon in casting steel. The use of cold ferrosilicon in the ladle chills the metal too much; melting it, or putting it into the metal in the furnace, cause excessive loss of silicon. The carborundum containing 62 per cent. of silicon is added cold to the ladle during tapping; its freedom from sulphur and phosphorus is one advantage, and it has been used to some extent in crucible steel. The facts that the material is light, floats on top of the steel, and that considerable loss of silicon thus results, while more time is necessary to get the silicon incorporated into the metal, are not mentioned in the article. J. W. Richards.

Specifications for Iron and Steel Structures. *Iron and Mach. World*, March 28, 1903. (Report of a committee of the Am. R. R. Engineering and Maintenance of Way Ass'n.).—The committee recommends that a single grade of rolled steel be used for all structural purposes, with tensile strength 60,000 pounds, minimum elongation 22 per cent., bending 180° flat without fracture, and with sulphur below 0.05, and phosphorus below 0.04 in basic steel and 0.08 in acid steel. For rivet steel, the tensile strength must be 50,000 pounds, elongation not specified, phosphorus not over 0.04 in acid steel, other requirements same as for structural steel. For steel castings, tensile strength not less than 65,000 pounds, elongation at least 18 per cent., should bend cold 90° without fracture, sulphur should be less than 0.05, phosphorus less than 0.05 in basic steel and 0.08 in acid steel. All steel castings must be annealed. A large number of other details are included in this excellent report. J. W. Richards.

The Copper Deposits of Bisbee, Ariz. By F. L. Ransome (*Preliminary Report of U. S. Geol. Sur.*).—The ores worked by the Copper Queen Company up to 1893 were oxidized, consisting of malachite, azurite, cuprite and native copper. Oxide ores are still abundant in soft, earthy masses associated with limonite and kaolin, but have been replaced in greater part by sulphide ore, pyrite mixed with chalcopyrite and some bornite. Arsenical and antimonial compounds of copper are absent. The ores are typical replacement deposits in limestone. The oxide and sulphide

ores are matted together in shaft furnaces, and the matte further treated by Bessemerizing. For over twenty years the Copper Queen Mine has produced over 16,000,000 pounds of copper annually. The article describes at length the geology of the region.

J. W. RICHARDS.

Copper Matte Blast-Furnace Practice. BY W. R. VAN LIEW. *Eng. Min. J.*, March 21, 1903.—A discussion of the width of furnace relative to tonnage obtained. The true standard to compare the workings of different types of furnaces is the tonnage smelted per square foot of hearth area at the tuyeres. The narrowest furnaces are 35 inches across at the tuyeres, the widest 56 inches; the length is immaterial. The narrower furnaces smelt more per square foot of hearth area, and economize power for blast pressure. A 56-inch furnace smelted 6 tons daily per square foot of hearth area, a 44-inch, 7 tons; a 42-inch, 8.7 tons; a 35-inch, between 10 and 11 tons. It is therefore more economical to increase the length of a furnace, to get greater output, than to increase its width above 35 to 40 inches. J. W. RICHARDS.

Progress in Electrolytic Copper Refining in 1902. BY T. ULKE. *Eng. Min. J.*, March 14, 1903.—The United States produces electrolytic copper at the rate of 764 tons per day, or 276,860 tons per year, valued at $72,503,600, which is 86.5 per cent. of the world's production. All Lake Superior copper contains silver, and a considerable proportion is being refined; it is only a question of time for it all to be. Current densities as high as 45 amperes per square foot are being used, which heat the electrolyte almost to boiling. Heavier anodes are now used than formerly, up to 400 pounds, reducing the percentage weight of scrap from 15 to 7. The American Smelting and Refining Company is introducing at its Perth Amboy plant the O. Hoffman method of regenerating the foul solutions by the use of roasted copper matte. The writer discusses favorably Johnson's explanation of the refining action, as given in *Trans. Am. Electrochemical Soc.*, *Vol. II*, and gives tables of the size and output of all the refineries in America and Europe. J. W. RICHARDS.

The Trail Smelter, British Columbia. *Eng. Min. J.*, March 28, 1903.—The capacity is 1,300 tons of lead and copper ores per day. It is operated by electrical power sent thirty miles. Only custom ores are worked. The copper-gold ores are low in copper. They are crushed, sampled, and roasted, if necessary, in heaps of 3,000 tons each. All transferring and hauling is done by 10 H. P. electric locomotives. Three large copper smelters have a capacity of 300 tons each; the first matte contains 10 to 12 per cent. of copper. It is granulated and roasted in O'Harra furnaces, briquetted and re-smelted to matte running 50 to 55 per cent. copper, which is shipped to the United States. The lead ores are principally sulphides rich in silver. They are crushed, sampled,

roasted in hand roasters or Bruckner cylinders, and smelted. The bullion is refined electrolytically by the Bett's process, which has been operating successfully since May, 1902. A new refinery with an output of 30 to 40 tons daily is being designed. (See these Abstracts, January, 1903.) J. W. RICHARDS.

Treatment of Slimes. *Eng. Min. J.*, March 28, 1903.—Mr. Addition has installed at the Confidence Mine, Tuolumne Co., Cal., tanks with conical bottoms, for treating the slimes. The ore contains about 60 per cent. of slimes, half of which can be treated with the sands, by cyaniding, while the other half must be treated separately. The slimes tanks are 20 feet in diameter, sides 9 feet deep, and with bottoms sloping at 50°. As soon as full, lime is scattered over the charge, the whole settled seven hours, and the liquor decanted. A valve is then opened in the bottom of the conical floor, and the slimes run into agitators, which are 12 feet in diameter, 8 feet on the sides, with bottoms sloping 45°. Cyanide solution is run in simultaneously, and two centrifugal pumps keep up the agitation for twelve hours. The pumps suck in at the surface and discharge at the bottom. To discharge, one pump is shut off, while the other pumps from the bottom of the tank into a filter press, holding 48 frames, 30 inches square by 2 inches thick. It requires thirty minutes to fill the press, thirty minutes to wash the cakes and one hour to discharge. The filling pressure reaches 78 pounds per inch. Washing continues until the solution shows only one-half pound potassium cyanide per ton. The gold is precipitated by zinc shavings. The sands treated are extracted to 85 per cent., the slimes 94 per cent.; the total cost of treatment per ton is 90 to 95 cents. J. W. RICHARDS.

Electrolytic Refining of Gold. BY D. K. TUTTLE. *Electrochemical Industry*, January, 1903.—The only process that is reduced to practice is Wohlwill's (U. S. Patents 626,863 and 625, 864). The feature patented is the electrolyte, which is a solution of gold chloride containing free hydrochloric acid. If the solution contains little or no free acid, chlorine is evolved at the anode and no gold is dissolved; as free acid is added, less chlorine escapes, and when a large amount is present the electrochemical equivalent of gold is dissolved. Additions of gold chloride are made from time to time equivalent to the copper, platinum, etc., which are dissolved but not deposited. The operation continues until the solution is highly charged with impurities. At the Philadelphia Mint a 5 H. P. dynamo furnishes the current; seven cells are run in series, each containing 12 anodes and 13 cathodes in multiple, the former 6 inches long, 3 inches wide, $1^1/_2$ inch thick; the cathodes are equal-sized, gold sheets 0.01 inch thick. The electrodes are 1.5 inches apart, temperature 50° to 55° C. The solution contains 30 grams of gold per liter, as trichloride.

The cells are white Berlin porcelain, 15 by 11 by 8 inches. The electrolyte is mechanically circulated. Voltage required 4½ to 5 volts for a set of seven baths, sending through 100 amperes. This refines 5,000 ounces per week, with 1 horse-power electric current. When the electrolyte is saturated with impurities, the gold in it is precipitated by sulphur dioxide, then the platinum left is separated as ammonium double chloride, lastly the copper is recovered by running over iron scrap. Silver falls to the bottom as slimes, if in small amount; if over 5 per cent. is present it forms an insoluble crust on the anode, which must be removed mechanically. Klondike gold contains 77.6 to 83.4 per cent. gold and 16.1 to 21.9 per cent. silver, and can only be treated by this process by alloying it with pure gold. Gold bars 99.98 per cent. pure are made, of a quality making the finest leaf.

J. W. RICHARDS.

Electrolytic Refining of Silver and Gold. BY T. ULKE. *Mines and Minerals*, March, 1903.—The first in the United States was a plant at the Pennsylvania Lead Co.'s works near Pittsburg, erected in 1886, and since dismantled. Its daily capacity was 30,000 to 40,000 ounces of doré bullion. A similar refinery was built later near St. Louis, but is not now in operation. In 1895 the Guggenheim plant at Maurer, N. J. (now part of the Perth Amboy plant of the American Smelting and Refining Co.), was built. In 1897 the Balbach Smelting and Refining Co. at Newark, N. J., erected a refinery; and in 1898 the Globe plant of the American Smelting and Refining Co. was started. The latter was not operated in 1902. The Philadelphia Mint has a small plant, started in 1902. For the principal details the writer refers to articles in Vols. II, IV, V, and VIII of "The Mineral Industry," and adds to this the following record of improvements: Thum's apparatus has the electrodes inclined, and movable horizontally so as to adjust their distance from each other. The silver is deposited on the lower inclined plate, and scraped therefrom without stopping the operation. The anode slimes are caught on an inclined diaphragm and collected in a trough at its lower end. Balbach's apparatus has no moving parts, but consists of a shallow tank lined with silver, silver-plated copper, or carbon, which lining serves as cathode, and anode cells dipped into the solution, covering the larger part of the tank. The anode cases have filter-cloth bottoms to catch the slimes. The tank bottom slopes up to one side, to allow the silver crystals to be raked out. The anode cases are easily lifted out, if necessary. The plant consists of a 72 kilowatt dynamo, delivering at present 1100 amperes at 34 volts. This runs 90 stoneware cells, depositing in them 30,000 Troy ounces of silver per twenty-four hours. The cells are in groups of 10, the 9 groups being in series and each group of 10 in parallel, taking 4 volts. The cathode lining is composed of carbon plates 12 inches square by a half inch thick. The anodes are 950

to 980 fine, and carry some copper; the electrolyte is silver nitrate; free acid is added daily and a part of the solution removed for purification. The Perth Amboy plant contains 120 tanks, is run by two 62 kilowatt generators, and can turn out 100,000 Troy ounces of silver daily, at full capacity. J. W. RICHARDS.

History and Present Development of Electrolytic Nickel Refining. BY T. ULKE. *Electrochemical Industry*, February, 1903. —A description of Vivian's electrolytic nickel-copper separating process, and works, at Swansea, Wales, the Papenburg nickel-copper refinery, in Germany, and the following American plants: Balbach's, at Newark, N. J., erected in 1894, the pioneer American plant. The writer confesses ignorance of the exact process used, and guesses at a method which is possibly used. The Cleveland Nickel Refinery, operated by the Canadian Copper Co., began to produce, in 1902, at the rate of eight to fifteen tons per month, using Browne's process. Anodes of copper-nickel alloy are used in hot copper-nickel chloride solution, the nickel accumulating in the solution as copper is deposited. The solution is regenerated by passing through a tower filled with matte or alloy, in contact with the chlorine evolved from the electrolytic tanks. When the nickel accumulates to a certain degree, the copper remaining is precipitated by hydrogen sulphide, the iron by ammonia, and the hot nickel chloride solution electrolyzed with carbon anodes. Larger works are being erected at Copper Cliff, Ontario. The Hamilton refinery, in Ontario, contained forty depositing tanks, and was started in 1900 to treat Sudbury ore by the Hoepfner process, but was remodeled to use the Frasch process. The plant is at present closed down. The Consolidated Lake Superior Co. propose erecting a copper-nickel refinery at Sault Ste. Marie, and plans have been prepared for a plant to produce daily 75 tons of copper and 7.5 tons of nickel. It is doubtful when this plant will be erected.

J. W. RICHARDS.

The Present Metallurgy of Aluminum. BY J. W. RICHARDS. *Electrochemical Industry*, January, 1903.—A history of the Hall and Héroult processes, and a discussion of the electrolytic principles involved. The writer shows that alumina dissolves in melted aluminum sodium fluoride to form a solution, that passing the electric current through the solution sets free aluminum at one pole and oxygen at the other, and argues therefrom that this is the primary effect of the passage of the current. The heats of combustion show that of the three compounds present in the bath, sodium fluoride has affinities corresponding to 4.7 volts, aluminum fluoride to 4 volts, alumina to 2.8 volts, which latter is reduced to 2.2 volts by the union of the oxygen with the carbon used as anode. It follows that the setting free of aluminum and oxygen should theoretically be the primary effect of passing a cur-

rent, and the burden of proof lies on any one who would maintain that this action is secondary. J. W. RICHARDS.

Some Laboratory Observations on Aluminum. BY C. F. BURGESS AND C. HAMBUECHEN. *Electrochemical Industry*, January, 1903.—The authors discuss the difficulty of soldering aluminum, and recommend as a flux potassium fluoride dissolved in acetone, resin added and zinc chloride sufficient to harden the mixture. On exposure to air this forms a paste, which can be applied as a flux. The thin coat of oxide on the metal also renders electro-deposition of other metals upon it difficult, *i. e.*, it is difficult to make the coating adhere. The authors have succeeded in overcoming this, and have obtained deposits adhering as well as on other metals, but do not state their methods. Used itself as a cathode, it is corroded continuously; as an anode it forms a thick, insulating coating which allows the current to pass in the reverse direction but not from the plate to the solution. This cuts off the reverse current, and makes it possible to get a direct current from an alternating current. If two aluminum plates are placed in a sodium-potassium tartrate solution, and an alternating current of 50 volts is applied, a distinct phosphorescence, caused by minute arcs, is seen at the anode, in the dark; higher voltages cause a brilliant sparkling effect. As a generator of electric current in batteries, it is as cheap as zinc, but it does not behave well, owing to the partly-insulating compounds formed on its surface. Mr. Mott has made determinations of single potential values of aluminum (against a normal calomel electrode assumed as —0.56 volt), showing values from 0.01 volt with potassium fluoride to 1.147 volts with sodium hydroxide. The conclusion is that ammonium fluoride would be the best battery fluid in which to immerse the aluminum, giving a cell of the Laclanché type having a potential of 2 volts. The physical condition of the metal makes considerable difference in the potentials given.
J. W. RICHARDS.

Aluminum as a Reducing Agent in Metallurgy. BY. G. P. SCHOLL. *Electrochemical Industry*, January, 1903. An illustrated account of the Goldschmidt process and its various applications. J. W. RICHARDS.

The Alloying of Metals as a Factor in Electroplating. BY L. KAHLENBERG. *Electrochemical Industry*, January, 1903. When one metal is deposited electrolytically upon another, the process of alloying always goes on to a greater or less extent. The alloying power of the deposited metal with the coated metal is a factor determining the strength with which the deposit adheres and the length of time the plated article will wear and resist corrosion. This alloying force is chemical in character, and is the tendency of the metals to dissolve in each other. The alloying of alkaline metals with a mercury cathode is already famil-

iar; but a thin plating of gold on lead forms an alloy at the junction, just as really, and the gold will gradually soak entirely into the lead at room temperatures. The mechanical character of the alloy formed is of importance ; if it is, or becomes, brittle or crystalline, it will easily chip off. Yet alloying is necessary for the adherence of a deposit, and therefore the electroplater must study the subject carefully so as to plate those metals or alloys upon each other which possess sufficient affinity for adhering well, but which diffuse very slowly into each other at room temperatures.

J. W. RICHARDS.

The Physical Character of Metal Deposits. BY C. F. BURGESS AND C. HAMBUECHEN. *Electrochemical Industry*, February, 1903. —Metals are almost invariably deposited in crystals, the appearance and character of the growth being determined largely by the size and shape of the crystals and their manner of aggregation. They may appear from spongy to coarse crystalline. The study of these forms is practically important, not so much as showing how they may be cultivated, but rather how they may be suppressed. Photographs of zinc, copper, iron, and lead "*trees*" are shown. The deposits vary much with the kind of solution used, and also with the additions made to them. Aluminum sulphate added to a zinc sulphate solution, carbon disulphide to a silver bath, gelatine to a nickel-plating solution, improve the deposits. Probably, the viscosity and surface-tension of the solution have some relation to the quality of deposit, and are influenced by the additions. The character of the deposit is also influenced by previously boiling the solution, or by whether the solution is made by dissolving the metal in acid or its salt in water. This points to dissolved gases influencing the nature of the deposit. The continuity and adherence of the deposit are very important in plating. The ability of the deposit to alloy with the metal underneath has some influence in the adhesion, but does not explain all cases, for copper deposited on copper adheres very strongly. In the latter case, the ordinary forces of cohesion come into play. Roughened surfaces are *wetted* easier by solutions than polished ones, and, therefore, receive more uniform deposits. Some solutions *wet* a given surface better than others, and various additions influence this *wetting* power. Aluminum in an *aqueous* solution of copper chloride receives a loosely-adherent coating of copper; in an *alcoholic* solution, a more firmly-adherent coat. Cohesion and smoothness always decrease as the deposit becomes thicker. Zinc gets moss-like growths. Iron roughens and gets grooves or furrows, caused by ascending columns of strong and dilute solutions. Small particles in suspension cause pitting ; gas bubbles cause blisters. Nickel peels off, owing to strains in the coating, after passing a certain thickness. Several fine photographs illustrate these cases.

J. W. RICHARDS.

Notes on Physical Characteristics of Electrodeposited

Metals. By W. McA. Johnson. *Electrochemical Industry*, February, 1903.—With a high electrode voltage, we are apt to get good, solid, adherent deposits. By the term *electrode voltage* is not meant the voltage across the terminals, but the voltage of the cathode against a standard electrode as measured by a potentiometer. This quantity is more important, as determining the character of the deposit, than terminal voltage or any other measurement which can be taken, for it gives the relative force pulling the cathions out of the solution. A double salt in solution, with a complex ion, causes a high electrode potential to be necessary; also furnishes the catholyte with a good supply of cathions, and therefore furnishes good deposits. A cloudy precipitate or suspended particles of any kind injure the deposit. In most cases the electric conductivity of such particles settling on the cathode is less than the normal deposit, shunting the current around the particle and building up current and material around it until it grows into a mound and covers up the particle, making warts. A hydrogen bubble causes like trouble. Frequent filtering is necessary to remove such suspended particles. Hot solutions are not to be recommended, since they favor the formation of basic salts. Fine deposits can be obtained from cold nickel solutions with low current densities. Electrodeposited nickel curls up because of molecular strain, proved by the fact that electrodeposited nickel is + towards cast nickel by 0.05 to 0.25 volt, which is due to the potential energy of an elastic body under strain. If it is annealed, it loses its strain and its overvoltage.

J. W. Richards.

The Abuse of Electroplating. By H. L. Haas. *Electrochemical Industry*, February, 1903.—The author advocates making all plating solutions as simple as possible, as it is then easier to find where the trouble is if anything goes wrong. A plater should know (1) what his solution is made of, (2) what changes the solution undergoes, (3) what chemicals he is adding to it, and their purity, (4) the purity of his anodes, (5) the voltage and amperage being employed, (6) the resistance of his solution, electrodes and connections, (7) the best distance to use between anode and cathode, (8) the amount of metal dissolved in a given time from his anodes, and (9) the amount of metal deposited in a given time on his cathodes. With silver and gold in cyanide solutions, very small anodes will keep up the strength of the solution; with nickel, large anodes, corrugated and one-third larger than the cathodes, keep up the strength of the bath and overcome many difficulties.

J. W. Richards.

Table of Electrochemical Equivalents and Their Derivatives. By C. Hering. *Electrochemical Industry*, January, 1903.—A carefully calculated table, from the most reliable data obtainable, giving for fifty of the most common elements, the milligrams depos-

ited per coulomb, grams per ampere hour, pounds per 1,000 ampere hours, and several reciprocals and derivatives of these. They are given for each of the separate valencies which an element may show, or for the changes of valency it may undergo. A list of the elements with their *practical* valencies, compiled by J. W. Richards, accompanies the table. By *practical* valency is meant the apparent valency of an element in a compound irrespective of any theory as to structural formula or double linkings; *e. g.*, Pb, tetravalent in PbO_2; C, univalent in C_2H_2. This idea is an application to electrolysis of O. C. Johnson's theory of + and — bonds. The illustrative examples given are numerous and well chosen, and will interest any chemist having to make electrochemical calculations. J. W. RICHARDS.

ORGANIC CHEMISTRY.

On Sodium Phenyl and the Action of Sodium on Ketones. BY S. F. ACREE. *Am. Chem. J.*, 29, 588–609.—Sodium phenyl was prepared from mercury phenyl and sodium, and found to react with alkyl, aryl and acyl halides, with ketones and other reagents, giving practically the same products as are formed when these substances are treated in ether solution with brombenzene and sodium, from which it is concluded that in those reactions where brombenzene and sodium are used (Fittig's, Frey's, Kekulé's, Wurtz's reactions), sodium phenyl is the intermediate product. EXPERIMENTAL. *Preparation of Sodium Phenyl.*—Mercury phenyl was dissolved in dry benzene or ligroïn and treated with fine sodium wire. Sodium amalgam collects on the bottom of the flask, while sodium phenyl remains suspended in the solution as a light brown powder. Sodium phenyl is rapidly decomposed by moisture and soon takes fire when exposed to the air on filter-paper. Sodium phenyl reacts with *ethyl bromide* or *ethyl iodide* to give ethylbenzene, and small amounts of benzene and ethylene; with *isoamyl iodide*, it gives isoamylbenzene, isoamylene and benzene; with *benzyl chloride*, diphenylmethane and stilbene; with *brombenzene*, diphenyl and a resinous liquid (not identified); with *benzophenone*, a nearly quantitative yield of triphenylcarbinol; with *benzoyl chloride*, triphenylcarbinol and a little benzoic acid; with *benzil*, phenylbenzoin, triphenylcarbinol and benzoic acid, and the same products are obtained by the action of brombenzene and sodium upon benzil. *Phenylbenzoin*, $(C_6H_5)_2C(OH)CO C_6H_5$, is insoluble in water, readily soluble in ether, alcohol or hot ligroin, crystallizing from the latter in radiating needles, m. p. 87°. It is decomposed into benzhydrol and benzoic acid by the action of methyl alcoholic potash. A blood-red color is produced when its solution in concentrated sulphuric acid is warmed, indicating dissociation into diphenylmethylene and other products. Heated for three hours at 240° in a stream of oxygen, in a long tube, it gave tetraphenylethylene, benzoic acid and benzo-

phenone. *The Action of Brombenzene and Sodium on Benzpinacone* gives triphenylcarbinol and benzhydrol. Sodium phenyl reacts with CO_2 to give a good yield of benzoic acid; with *chlorcarbonic ether*, it gives triphenylcarbinol and only a small amount of benzoic ether. *The Action of Brombenzene and Sodium on Benzoic Ether* results in the formation of triphenylcarbinol, triphenylmethane, benzophenone, and occasionally benzoic acid also. *The Action of α-Bromnaphthalene and Sodium on Benzophenone* gives benzoic acid, naphthalene and *α-Naphtyldiphenylcarbinol*. The latter is also formed by the action of brombenzene and sodium upon α-naphtylphenylketone. It melts at 135°, is insoluble in water or ligroïn, but easily soluble in ether or alcohol. *The Action of p-Bromtoluene and Sodium on Benzophenone* gives a poor yield of *p*-tolyldiphenylmethane. This same substance was also prepared by the action of brombenzene and sodium on *p*-tolylphenylketone. No *p*-tolyldiphenylcarbinol appears to be formed in either case.—*The Action of Sodium on Ketones.*—It is shown that the experimental results are best explained by the hypotheses and formulas of Nef. *The Action of Sodium on Benzophenone* gives benzpinacone and benzhydrol. *The Action of Sodium and CO_2 on Benzophenone* gives benzilic acid. *On the Isomeric Diacetyldioxystilbenes.*—Thiele's lower melting isomer is shown to be identical with Nef's diacetyl dioxystilbene. When pure it melts at 118°, not at 110° as given by Thiele.

M. T. BOGERT.

The Action of Zinc on Triphenylchlormethane. (Second paper). BY JAMES F. NORRIS. *Am. Chem. J.*, **29**, 609–616. The first paper upon this subject by Norris and Culver (*Am. Chem. J.* **29**, 129 (1903)), was criticized by Gomberg (*Ibid.*, April 1903). The present paper is a reply to Gomberg. The author is of the opinion that Gomberg's article was evidently written after a very hasty reading of the experimental evidence submitted, that his criticisms are not well founded, and that his explanations of the results obtained by Norris and Culver are not in accord with the facts. Data in support of the author's position are given in full, classified under the headings: (1) Action of Sodium; (2) Is the Reaction Quantitative?; (3) Action of Zinc in Ethyl Acetate; (4) Absorption of Oxygen; and (5) Yield of the Peroxide. In conclusion the author says: "I believe that not a single point brought out by Gomberg has a bearing on our experimental work and conclusions." M. T. BOGERT.

Upon the Structure of the Starch Molecule. BY F. E. HALE. *School of Mines Quart.*, **24**, 145–171.—A review of the results secured by the various investigators who have worked in this field, and the development of a constitutional formula for the starch molecule based upon these data. The author believes the structural formula which he proposes to be "an appropriate graphical

representation of the facts concerning starch, because it explains so many results of starch hydrolysis; molecular size, intermediate production of maltodextrins, dextrins with or without reducing power and of various rotatory powers, hydrolysis by acid, alkali, or other reagents, hydrolysis of amidulin by iodine, a possible explanation of the formation of the red and blue iodides, condensation into larger bodies and into insoluble starch cellulose, and a residue not easily attacked by diastase. It brings into harmony the results of Brown and Heron, Brown and Morris, Herzfeld, Musculus and Grüber, Bondonneau, Lintner and Düll, Scheibler and Mittelmeier, Lintner, O'Sullivan, Johnson, Mylius, Girard, and many others, including a portion of Syniewski's work." (The formula is too extensive to permit of reproduction here.)

M. T. BOGERT.

Further Consideration of Isocinnamic Acid. BY A. MICHAEL AND W. W. GARNER. *Ber. d. chem. Ges.*, 36, 900–908.—It has been shown in a previous paper that when an alcoholic solution of *β*-bromallocinnamic acid is boiled with zinc dust, there is formed, in addition to the ordinary and the allocinnamic acids, a very small amount of a lower melting substance (m. p. 36°) which was regarded as a third stereomeric cinnamic acid ("isocinnamic acid"), and which agreed in many respects with the isocinnamic acid obtained by Liebermann from cocoa nibs. As it was possible that the authors' isocinnamic acid might be made up of hydrocinnamic and allocinnamic acids, a mixture of these two was prepared and found to resemble it closely in properties. The work has not been completed because recent attempts to prepare the substance in quantity have failed. The authors, therefore, agree with Liebermann that the existence of "isocinnamic acid" as a chemical individual has not as yet been conclusively demonstrated, although certain facts have been observed for which a satisfactory explanation is still lacking. EXPERIMENTAL. By *reducing β-bromallocinnamic acid* with zinc dust and alcohol and separating the acids formed by the different solubility of their barium salts in methyl alcohol, small amounts of low melting acids were obtained (m. p. 36°–38°, 43°–45°, etc.). *Salts of Isocinnamic Acid.—Aniline salt*; needles (from ligroïn), m. p. 83°, giving allocinnamic acid (m. p. 68°) when decomposed with sodium carbonate solution. *Barium salt*; leaflets, easily soluble in water. *Calcium salt*; its aqueous solution on acidifying gives an acid melting at 38°–39°. *Salts of Allocinnamic Acid.—Barium salt*; crystallizes from water in prisms. *Calcium salt*; fine needles, behaves in a peculiar manner with acetone. *Salts of Hydrocinnamic Acid.*—The properties of the *barium* and *calcium salts* are recorded. *Mixture of allo- and hydrocinnamic acids.* These acids were mixed in various proportions and the melting-points of the mixtures are tabulated. A mixture containing about 73 per cent. of the allo and 27 per cent. of the hydro acid melts at 37°–38°.

A mixture of 69 per cent. allo and 31 per cent. hydro acid was converted into barium salt, which, dried and pulverized, dissolved completely in an equal weight of methyl alcohol, and when acidified yielded a product melting at 36°. The *detection of hydrocinnamic and allocinnamic acids* when present together can be accomplished by changing the allo to the ordinary cinnamic acid, the latter being almost insoluble in ligroin, while hydrocinnamic acid dissolves easily in this solvent. Isocinnamic acid when treated thus gives results almost identical with those obtained from a mixture of allo- and hydrocinnamic acids. It is also possible to determine allocinnamic acid in presence of hydrocinnamic by titration with potassium permanganate solution under suitable conditions. A combustion of isocinnamic acid (from β-bromallocinnamic) gave figures agreeing more closely with those calculated for a mixture of 80 per cent. allo acid with 20 per cent. hydrocinnamic than with the theory for isocinnamic acid.

M. T. BOGERT.

On Tetraphenylmethane. BY M. GOMBERG AND H. W. BERGER. *Ber. d. chem. Ges.*, 36, 1088–1092.—In 1897, Gomberg published an article upon the preparation of tetraphenylmethane from triphenylmethanazobenzene. A further study of this hydrocarbon was contemplated, to establish its character more satisfactorily, and certain work was done in this direction. The preparation of tetraphenylmethane recently by Ullmann and Münzhuber, however, and the identity of their product with that obtained by Gomberg, renders a continuation of this work unnecessary. The authors, in discontinuing this line of investigations record the experiments already carried out. EXPERIMENTAL. *Triphenylmethanehydrazobenzene*, $(C_6H_5)_3CNHNHC_6H_5$, is best prepared by the action of triphenylchlormethane upon phenylhydrazine in absolute ether solution, the yield of crude product being 90 per cent. of the theory. From hot absolute alcohol, it separates in nearly colorless crystals, m. p. 136°–137°. *Triphenylmethanazobenzene*, $(C_6H_5)_3C.N:N.C_6H_5$.—The hydrazo body is best oxidized by dissolving it in ether and passing in nitrous vapors. Evaporation of the ether leaves the azo compound in beautiful yellow crystals melting with decomposition at 113°–114°. In several cases, quantitative yields were secured. *Tetraphenylmethane.*—The finely pulverized azo body, mixed with three or four volumes of pure dry sand, is added carefully to a distilling flask kept at 100° on the oil-bath, and through which a current of carbon dioxide is kept constantly passing. The tetraphenylmethane is extracted from the mass with benzene, the yield being usually only 2 to 5 per cent. Recrystallized from benzene, it becomes snow-white, and melts at 281.5°–282° (uncorr.). It is identical with the product obtained by Ullmann and Münzhuber. *Nitro derivative.*—By dissolving tetraphenylmethane in cold fuming nitric acid, a trinitro derivative is obtained which, when crys-

tallized from benzene and then from ethyl acetate, forms faint yellow crystals melting at about 330°. Reduced with zinc dust, a fuchsine-colored solution results, apparently showing the same absorption spectrum as the dye-stuff prepared from triphenylmethane. M. T. BOGERT.

BIOLOGICAL CHEMISTRY.

The Influence of Formaldehyde on the Action of Certain Laking Agents and on Coagulation of Blood. BY CHARLES CLAUDE GUTHRIE. *Am. J. Physiol.*, 9, 187–198.—Coagulation is retarded in blood drawn into solutions of formaldehyde in proportion to the amount of formaldehyde present in the resulting mixture. Formaldehyde in sufficient amount prevents coagulation indefinitely, but the amount necessary to do this varies with different animals of the same species. In eight experiments, seven dogs and one rabbit being used, the amount necessary to prevent coagulation ranged from 1 part of formaldehyde to 66.6 parts of blood to 1 : 400, and gave an average of 1 : 185.5. Amounts of formaldehdye, too small to prevent coagulation, prevent the clot from advancing beyond a delicate jelly-like stage, for a period proportionate to the amount of formaldehyde present. The onset of spontaneous laking at room temperature is not markedly delayed by small quantities of formaldehyde, but, once begun, it proceeds much more slowly than in normal blood. Rabbit's blood plus formaldehyde, in the proportion of 1 : 1000, is moderately laked by dog's serum. Large amounts prevent laking. Dog's serum plus formaldehyde in the proportion of 1 : 2000 or less, still retains its power of laking rabbit's corpuscles, the amount of laking depending on the proportion of formaldehyde added. Serum from blood drawn from a dog after injection of formaldehyde in the proportion of 1 : 1500, lakes rabbit's corpuscles as energetically as serum from blood drawn before the injection. Mixture of formaldehyde bloods and sera, containing more than enough formaldehyde to prevent biological laking, are rapidly and strongly laked by water or sapotoxin solution in 0.9 per cent. sodium chloride solution. Spectroscopically, no obvious change is discoverable in the haemoglobin when formaldehyde is added to blood in the proportion of 1 : 166, after a period of four days, or after the action of smaller amounts for longer periods of time. Blood can be well preserved for a number of days at room temperature by adding potassium oxalate in sufficient amount to prevent coagulation, and formaldehyde in the proportion of 1 : 1000 : 500 or more, to retard laking and putrefaction. F. P. UNDERHILL.

The Artificial Method for Determining the Ease and the Rapidity of the Digestion of Meats. BY HARRY SANDS GRINDLEY AND TIMOTHY MOJONNIER. *Studies Univ. Illinois*, 1, No.

5, 185–202.—The method employed in these experiments was as follows: The weighed quantities of meat are treated in small beakers, with 100 cc. of the acid pepsin solution containing 1.25 grams pepsin per liter of 0.33 per cent. hydrochloric acid. The solution and the samples of meat are thoroughly stirred and placed at a temperature of 38° to 40° C. for varying periods of time. When it is desired to stop the digestion, 10 cc. of formalin are added. The solutions are then immediately filtered, thoroughly washed and the nitrogen in the residue determined by the Kjeldahl method. The results of the investigation show that there is a difference in the ease and rapidity of digestion of raw and cooked meats, the raw meat being more readily digested. Meat cooked by boiling is more readily digested than meat broiled or fried. F. P. UNDERHILL.

On the Nucleoproteids of the Pancreas, Thymus, and Suprarenal Gland, with Special Reference to Their Optical Activity. BY ARTHUR GAMGEE AND WALTER JONES. *Hofmeister's Beiträge*, **4**, 10–23. See also *Am. J. Physiol.*, **8**, 447–456, and abstract this review. F. P. UNDERHILL.

III. The Preparation and Analysis of Some Nucleic Acids. BY P. A. LEVENE. *Ztschr. physiol. Chem.*, **38**, 80–84.—In the present article the author has continued his investigation on the nucleic acid of the spleen. Cytosin obtained from the spleen gives reactions very similar to those of the thymus cytosin, studied by Kossel and Stendel. Besides obtaining cytosin and thymin, Levene has also succeeded in isolating uracil from the spleen, and according to this investigator uracil may probably be looked upon as a secondary product. F. P. UNDERHILL.

A Study of the Physiological Action and Toxicology of Caesium Chloride. BY G. A. HANFORD. *Am. J. Physiol.*, **9**, 214–238.—Experiments upon frogs show that no marked differences exist between the effect of $\frac{N}{8}$ solutions of sodium chloride and caesium chloride upon the red corpuscles and cilia. Isolated muscles contract spontaneously in such solutions and the contractions cease sooner in caesium chloride than in sodium chloride. Muscles exposed to caesium chloride lose their irritability toward electrical stimulation sooner than those exposed to sodium chloride. The irritability of nerves disappears sooner in caesium chloride than in sodium chloride. Complete paralysis is produced by considerable doses of caesium chloride (1 to 2.5 milligrams per gram body weight). No initial excitability was noted. The caesium seems to act on both nerves and muscles. In the rabbit, cat, and dog, final paralysis followed the subcutaneous injection of caesium chloride. Two grams per kilo body (subcutaneously) proved fatal to a rabbit. One-half to one gram per kilo body weight usually proved fatal to a cat or dog. The symptoms elicited were those of intense gastro-in-

testinal disturbance, vomiting, diarrhoea, loss of reflexes, and progressive paralysis. Intravenous injection produced an initial fall, followed by a marked rise in blood pressure in both cats and dogs. The lymph-flow from the thoracic duct was slightly accelerated. Fatal doses (about $^3/_4$ of a gram per kilo body weight) caused death by cardiac failure. Proteid metabolism was not noticeably disturbed by doses of from 40 to 275 milligrams per kilo of body weight fed for several days. Sulphur and phosphorus metabolism were also unaffected. Chlorine elimination was also unchanged, except that the added amount fed with the caesium was rapidly excreted. No diuretic action was obtained. When larger amounts were given per os, marked gastro-intestinal disturbances resulted. Elimination of the caesium by the intestine and kidneys was comparatively rapid, no prolonged retention being noted. In man, the caesium was detected in the urine within an hour after injection of 375 milligrams of caesium chloride.

F. P. UNDERHILL.

The Reducing Enzymes. BY M. EMM. POZZI-ESCOTT. *Am. Chem. J.*, **29**, 518–563.—A résumé of the various reducing enzymes found in the animal and vegetable kingdom together with some suggestions as to their mode of action and significance.

F. P. UNDERHILL.

The Germicidal Action of Alcohol. BY CHARLES HARRINGTON AND HAROLD WALKER. *Boston Med. and Surg. J.*, **148**, 548–552.—Against dry bacteria, absolute alcohol and ordinary commercial alcohol are wholly devoid of bactericidal power, even with twenty-four hours' contact, and other preparations of alcohol containing more than 70 per cent. by volume, are weak in this regard, according to their content of alcohol, the stronger in alcohol, the weaker in action. Against the commoner, non-sporing, pathological bacteria in a moist condition any strength of alcohol above 40 per cent. by volume, is effective within five minutes, and certain preparations within one minute. Alcohol of less than 40 per cent. strength is too slow in action or too uncertain in results against pathological bacteria whether moist or dry. The most effective solutions of alcohol against the strongly resistant (non-sporing) bacteria, such as the pus organisms, in the dry state, are those containing from 60–70 per cent. by volume, which strengths are equally efficient against the same organisms in a moist condition. Unless the bacterial envelope contains a certain amount of moisture, it is impervious to strong alcohol; but dried bacteria, when brought in contact with dilute alcohol containing from 30–60 per cent. water by volume, will absorb the necessary amount of water therefrom very quickly, and then the alcohol itself can reach the cell protoplasm and destroy it. The stronger preparations of alcohol possess no advantages over 60–70 per cent. preparations.

F. P. UNDERHILL.

The Nature of Nerve Irritability and of Chemical and Electrical Stimulation. Part II. BY A. P. MATHEWS. *Science*, 17 (New Series), 729–733. This article is a continuation of the work of the author and the results here recorded may be taken as confirmatory of the results previously published.

F. P. UNDERHILL.

The Relation of Inorganic Salts to Protoplasmic Movements. BY A. P. MATHEWS. *Yale Med. J.*, 9, 399–418. The conclusions that may be drawn from this paper are as follows: Inorganic salts are absolutely essential to protoplasmic activities, because by means of their dissociation in water they form an electric substratum in which protoplasmic processes go on. This substratum must be practically neutral; that is, there must be present both negative and positive particles, but these particles must be potentially equivalent. To bring about a condition of absolute neutrality, there must be a mixture of salts in definite proportion, because in no salt yet known are the two ions exactly balanced. For this reason no single salt solution, so far tried, can sustain protoplasmic activity. All single solutions are poisonous. Any change in this electrical substratum produced by the electric current, or by the introduction of salts of different electrical efficiency, or by the action of light, produces a change in protoplasmic activity. That change is toward an increase in activity in the motor nerve at least, if the change is toward a predominant negative ion; toward a decrease in activity if toward the positive side. Inorganic salts act upon protoplasmic activity, primarily at least by disturbing the protoplasmic equilibrium of this substratum. Potassium chloride, lithium chloride, calcium chloride, hydrochloric acid, disturb it toward the positive side, sodium hydroxide, sodium chloride and other salts of sodium toward the negative side. By changing this equilibrium very slightly, for example by varying the relative amounts of inorganic salts in the blood, a condition of depression or stimulation may be produced and extended over very long periods. The action of mineral water and intravenous salt solutions depends upon this principle, and we are now in a position to employ these agencies upon a scientific basis. The physiological action of inorganic salts is an electrical action due to the charges on the ions of these salts. The physiological action of any salt is equal to the sum of the actions of its ions. Recognizing that negative and positive ions have opposite actions, electrical stimulation may now be explained.

F. P. UNDERHILL.

Limitations of the Dimethylamidoazobenzol Test for Free Hydrochloric Acid in the Stomach Contents. BY WILBUR F. SKILLMAN. *Am. Med.*, April 18. Lactic acid, in amounts of 2 per cent. or more in the gastric juice, will give with Töpfer's reagent a reaction resembling the one due to free hydrochloric acid. If the test for lactic acid is positive, Günzberg's or some other re-

agent should be used to determine whether the dimethyl reaction is due to lactic or to free hydrochloric acid.

F. P. UNDERHILL.

The Influence of Certain Alcoholic Liquors, and Tea and Coffee, upon Digestion in the Stomach. BY RICHARD F. CHASE. *Phila. Med. J.*, 11, 941–943.—The results of the experiments here recorded show that salivary digestion is slightly delayed by whiskey and somewhat accelerated by beer; the influence in either case, however, is not sufficient to be of much significance. Peptic digestion, both in the stomach and test-tube, is noticeably delayed by whiskey and to a greater degree by beer, in the latter case quite out of proportion to the amount of alcohol contained in the beer. Secretion was probably somewhat increased by whiskey and to a less extent by beer. Tea and coffee taken with meals do not retard salivary or peptic digestion, and salivary digestion seems to be slightly accelerated by tea. These beverages act as mild stimulants to gastric secretion; the digestive power of the secretion is not augmented, however, nor is it decreased.

F. P. UNDERHILL.

PATENTS.

DECEMBER 30, 1902.

717,183. Hans A. Frasch, Hamilton, Canada. **Cobalt ammonium salt.** Ores or mixtures of cobalt and nickel which may contain other metals are dissolved with excess of ammonia, the nickel and cobalt are then thrown down by common salt, the precipitated nickel cobalt ammonium salt separated by water which dissolves the nickel ammonium salt and precipitates the cobalt as hydroxide.

717,184. Hans A. Frasch, New York, N. Y. **Making starch.** Corn is soaked in water, then frozen, and after thawing the starch is separated.

717,195. John J. Hill, Denver, Col. **Amalgamating paratus.** A supporting frame, basins holding quicksilver, a copper cylinder with ribs of material without affinity for quicksilver, and a pulp passage between said basin and cylinder.

717,299. George C. Stone, Newark, .N J. **Extracting zinc and lead from sulphide ores.** The oreis smelted, the volatile constituents oxidized at their exit from the furnace, and the oxidized constituents passed through wet scrubbers in which the sulphurous acid is absorbed and the zinc oxide dissolved, the resultant solution is again passed through the scrubbers and filtered, heated to precipitate zinc sulphite and drive off sulphurous acid gas which is returned to the scrubbers.

717,328. Henry S. Blackmore, Mt. Vernon, N. Y. **Reducing metals and making metallic hydroxides.** Oxygen and sodium

carbonate are passed through melted metallic lead, the resulting compound is exposed to hydrogen, and the sodium hydroxide withdrawn, while more sodium carbonate and oxygen are added to the reduced lead.

717,355. Charles F. Cross and Edward J. Bevan, London, England, and Clayton Beadle, Erith, England. Assignors to Cellulose Products Co., Wilmington, Del. Treating **viscose.** A weak acid is applied to it such as acetic acid, and then it is acted on by brine or alcohol.

717,369, Stefan Epstein, Paris, France. **Photographic plates** for printing heliotypographic plates for book presses are made by heating the metal plate to 50° C., covering it with a mixture of gelatine bichromate, acid, alcohol and water, raising its temperature to 100° C., permitting it to cool, printing on it the negative, washing first with water, and then with glycerin and water in a vacuum.

717,441. Lewis McDaniel, Tabor, Iowa. **Explosive.** Smokeless powder made from sugar syrup, potassium chlorate and saltpeter stirred and mixed till granulated, then agitated in the presence of gasoline.

717,519. Emile de Meulemeester, Brussels, Belgium. **Yeast.** Extracting the protoplasm of yeast by acting on it with sodium chloride or carbonate so as to liquefy the mass in a cold state, allowing fermentation to be well established, and adding fresh quantities of yeast without checking the fermentation.

JANUARY 6, 1903.

717,536. Friedrich Breyer, Kogel, Austria-Hungary. **Softening water.** Sand is treated with lime to form a crystalline coating thereon, then mixed with the water so as to be held in suspension therein, while caustic soda and caustic lime are added and carbon dioxide blown in to precipitate the excess of lime, then the water is filtered.

717,550. Jens Dedichen, Berlin, Germany. Assignor to Actien Gesellschaft für Anilin Fabrikation, same place. **Black polyazo dye.** A tetrazo-*p*-diamine is caused to react on 1,8-aminonaphthol-3,6-disulphonic acid and the product is combined with a diazo body and then with an *m*-diamine. The diazo compound enters the naphthalene nucleus, if the reaction is carried out in the presence of an acid, whereas in the alkaline reaction of German patent 97,437 the intermediate product is made in an alkaline solution.

717,565. Adolf von Gernet, London, England. **Extracting copper.** The pulped ore is passed through a trough in a contrary direction to that of a current of sulphurous acid at slow speed, forming cuprous sulphite that is roasted for metallic copper.

717,607. Leonard Paget, New York, N. Y. Assignor to Charles Coster, same place. **Storage battery electrode.**

Presses arborescent crystals of lead into shape, deposits on them a thin shell of lead peroxide, and forms the plate electrically into a storage battery, oxygen electrode.

717,608, 717,609 and 717,610 are to same for similar plates.

717,699. Augustus P. Murdoch, Oswego, N. Y. Apparatus for making **starch.** A vat with outlets at different levels for drawing off gluten water and starch liquor separately, and discharging into a grinding mill which in turn discharges into the first vat of three series of conical vats placed small end down through which the precipitate is drawn off; the liquor passing usually from the top of one vat to the bottom of the next.

717,744. Martin Hahn, Munich, Germany. **Fermented beverage.** An albuminous, slightly alcoholic, and nutritious beverage obtained by adding blood to hopped and cooled beer wort, then adding yeast, fermenting at low temperature, and charging with carbon dioxide.

717,749. Oscar Jaeck, Elberfeld, Germany. Assignor to Elberfeld Co., New York, N. Y. **Dyeing process.** Textile fabrics dyed with sulphur dyes are treated with neutral sulphites, 1 or 2 per cent., by which the colors are made faster or brighter.

717,793. Leon M. J. Armandy, Asnieres, France. **Photographic films.** A varnish of gum lac is applied to a suitable backing, on this a coat of resin, then gelatine mixed with starch or barium sulphate, and on this the sensitive film. The whole adapted for stripping.

717,833. Owen J. Flanigan, Boston, Mass. **Composition for soldering sticks.** Spermaceti 15, mutton tallow 5, and acetic acid 1 part.

717,840. Hans Goldschmidt, Essen-on-Ruhr, Germany. Assignor to Clarence B. Schultz, Berlin, Germany. **Joining metal pieces.** Surrounds the joint with a mold, fills a crucible with a mixture of aluminum and a metallic compound of oxygen as iron oxide, places the crucible over the joint, ignites the mixture, and allows the molten metal to run into the joint through a hole in the bottom of the crucible.

717,864. John T. Jones, Iron Mountain, Mich. **Treating ore.** Mixes sulphurous gas with copper pulp in a rotary barrel at a temperature below 42° C.; above this temperature sulphates are formed.

717,944. James Thame, Twickenham, England. **Plastic wall decoration.** Mixes the gum of Dyera costulata, known as "Fluvia" or "Pontianak," with vegetable fiber and zinc oxide or similar filling.

718,028. Conrad Schraube and Walter Voightlander-Tetzner, Ludwigshafen-on-Rhein, Germany. Assignors to Badische

Anilin und Soda Fabrik, same place. **Mixed disazo dye.** Made by combining 1,5-naphthalenediamine, tetrazotized with salicylic acid and this compound with another azo compound different from salicylic acid. Wool dye which on reduction, yields 1,5-naphthalenediamine, aminosalicylic acid and 1,2- aminonaphthol 3,6-disulpho acid.

718,032. Walter Voigtlander-Tetzner, Ludwigshafen-on-Rhein. Assignor to Badische Anilin und Soda Fabrik, same place. **Azo dye.** Diazotized *m*-aminobenzeneazosalicylic acid is combined with 1-naphthol-4-sulpho acid; the resulting dye yields, on reduction with zinc dust, caustic soda and hydrochloric acid, metaphenylene diamine and paramino salicylic acid, dyeing red to brown shades.

718,036. Heinrich Titze, Vienna, Austria-Hungary. **Imitating paintings on glass.** A design is drawn on lithographic stone, the printing roller is coated with a transparent vitrifiable paint with which is mixed a compound of lithographic varnish, resin and Venice turpentine boiled together, this coating is rolled into the design, transferred to metachromotype paper, powdered with pulverized transparent paint, dusted off, the glass used is coated with transparent varnish and an impression on it taken from the print, after a partial drying of the varnish, water soaking the paper off the glass and drying and burning the glass.

JANUARY 13, 1903.

717,087-8-9. All to Franklin R. Carpenter, Denver, Col. **Recovering precious metals.** The first for smelting the ores alone, then bringing the molten mass in contact with melted lead, the second for smelting iron matte containing precious metals and bringing the mass in contact with melted lead in an oxidizing atmosphere, the third adds the iron when it is not present as the first step.

718,099. Stanley C. C. Currie, New York, N. Y. Assignor one-fourth to William Courtenay, same place. **Reducing ores.** A hot gaseous compound containing oxygen is caused to react on ores containing precious metals, washing out the soluble portion with water, repeating this treatment till all soluble matter is extracted, then treating with hot caustic alkali, and precipitating in the usual way. Steam may also be used.

718,151. Melville G. Peters and James A. Shepard, Glasgow, Scotland. **Fabric coating.** Tragasol gum 10, dried linseed oil 11, a drying compound 1, and a filler as whiting or cork-dust 26 parts.

718,181. Arthur Weinberg, Frankfort-on-Main, Germany. Assignor to Leopold Cassella Co., same place. **Blue wool dye.** Paradiazoacetalkylaniline is combined with the sulpho acids of 1,8-dioxynaphthalene, and the product saponified, forming a dark bronzy powder, soluble in water reddish blue, in dilute soda-lye

blue-red, in dilute acid scarlet, in concentrated sulphuric acid red-violet.

718,222. Wilhelm Schulte, Overpelt Neerpelt, near Limberg, Belgium. **Reducing zinc.** Smelting oxidized zinc ores by impregnating them with hydrocarbons, adding less coal than necessary for reduction, and distilling the mixture.

718,253. Herbert A. Hobson, London, England. Assignor to Concentrated Beer Co., same place. **Concentrated hopped wort.** Lupulin is extracted from hops which are then heated with water and the infusion digested with albuminous matter, whereby an extract free from tannin is obtained, from which the mash is made, and then concentrated and the lupulin added.

718,312. Albert Cobenzl, Bingen, Germany. **Silver bromide gelatine.** The emulsion is treated hot by alcohol, then allowed to ripen and cooled by agitation, so that the silver bromide gelatine separates as a fine-grained, sandy powder containing the soluble salts and nearly panchromatic.

718,318. August H. Cronemeyer, New York, N. Y. **Solidifying hydrocarbons, etc.** Sodium hydroxide 2, water 3, alcohol and stearine 10 each, colophony 5, and an inflammable hydrocarbon 100 parts. May heat the mixture.

718,335. Adolph Frank, Charlottenburg, Germany. **Cementation.** An oxide of carbon reacts on a carbide in the presence of the metal to be cemented at a temperature high enough to separate the carbon.

718,340. Otto J. Graul, Ludwigshafen-on-Rhine, Assignor to Badische Anilin und Soda Fabrik, same place. **Cyanmethyl derivatives of aromatic amines.** An anhydro-formaldehyde aromatic amino compound is treated with an alkaline bisulphite and the product with a salt of hydrocyanic acid.

718,342. Louis Haas, Mannheim, Germany. Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine. Germany. **Sulphur dye.** The sodium salt of dinitrobenzene sulphonic acid is melted with sodium sulphide and sulphur, making a dye insoluble in cold 10 per cent. solution of sodium carbonate, and 1 part will not be wholly dissolved within one hour by 10 parts of a solution of sodium sulphide containing 50 grams of the crystalline salt to 100 cc. It dyes brown, unchanged by bichromate and acetic acid, but turning reddish with β-naphthol and nitrous acid.

718,356. Paul Julius, Ludwigshafen-on-Rhine, Germany. Assignor to Badische Anilin und Soda Fabrik, same place. **Red azo dye.** A mono azo dye which, on reduction with hydrochloric acid and stannous chloride, yields α-amino-β-naphthol and 2-naphthylamino-1,5-disulpho acid.

718,389. Conrad Schaube and Walter Voigtlander-Tetzner, Ludwigshafen-on-Rhine, Germany. Assignors to Badische Anilin

und Soda Fabrik, same place. **Red azo dye.** From tetrazotized benzidine, *p*-cresol and 2-naphthol-6,8-disulpho acid, which on treatment with caustic soda, zinc dust and carbon dioxide yields benzidine and 3-amino-4-hydroxytoluene, and on treatment with hydrochloric acid, common salt and stannous chloride gives 1-amino-2-naphthol-6,8-disulpho acid.

718,437. Herbert H. Dow, Midland, Mich. **Electric light carbons.** Saturates carbonaceous particles with a binder in the state of vapor or gas, as tar or pitch atomized, then molding and baking. Each particle is thinly coated and the product is very dense.

718,438. **As above.** Carbonaceous material and binder, as tar, and a liquid, as water, in which the binder is insoluble, grinding the mixture and removing the liquid, then pressing, molding and baking to obtain a dense carbon.

718,465. William M. Jewell, Chicago, Ill. **Purifying water.** A coagulant, as alum, is added to the water, which is then passed through a filter bed to take up the coagulant, then passing water in the reverse direction through the bed to remove the coagulant and treating this wash-water with sulphurous acid to dissolve the coagulant and fit it for reuse.

718,537–8. Frederic J. Smith, Elizabeth, New Jersey. Assignor to William H. Bowker, Boston, Mass. **Bordeaux mixture.** The first for milk of lime, rosin oil and blue vitriol, the second for blue vitriol and calcium carbide.

718,554. Wm. G. Waring, Tyrone, Pa. **Extracting zinc.** Dilute mine or other waters containing less than 1 per cent. of zinc or other metals are treated with a soluble sulphide to precipitate the copper, silver or cadmium group, as sulphides, then drawing off the clear liquor and adding hydrogen sulphide in excess, thereby separating the zinc sulphide and finally heating to 150° to 180° F. to separate the zinc sulphide and regenerate the acid for reuse.

718,555. As above; for **White pigment.** A solution of zinc sulphate and chloride in definite proportions is precipitated by a mixture of magnesia in a solution of barium chloride exactly equal to the zinc salts; after separating the pigment, the residual solution is evaporated, mixed with 25 per cent. of magnesia and calcined in contact with steam to recover the hydrochloric acid and magnesia, etc.

718,556. Wm. G. Waring, Tyrone, Pa. **Hydrogen sulphide** from furnace gases. Sulphur dioxide is absorbed in a strong solution of sodium sulphite, adding barium carbonate and storing the pure carbon dioxide evolved, calcining the barium sulphite with coal, and reacting with carbon dioxide, stored, on the barium sulphide thus formed to regenerate the barium carbonate and make hydrogen sulphide.

JANUARY 20, 1903.

718,601. Franklin R. Carpenter, Denver, Colo. Assignor one-half to Joseph H. Berry, Detroit, Mich. **Separating precious metals from matte.** Adds iron to liquid matte, granulates it, and leads it at a temperature insufficient to fuse the matte, but high enough to cause absorption of the precious metals from it.

718,633. Thomas B. Joseph, Mercur, Utah. **Gold extracting process.** Leaches the ore with a solution of potassum cyanide, calcium hydroxide and carbon dioxide in water, the latter forced in with air to oxidize the metals which are afterwards precipitated by zinc or otherwise.

718,651. Wm. J. McConville, Lawrence, Mass. **Dyeing raw stock.** The stock is fed in small quantities into a trough containing a standard dyeing solution, discharging the stock and dye liquor together into the vat, passing it through and out of the vat in a continuous manner and returning the solution to the trough where a predetermined quantity of fresh solution is added, and applying this mixture to the raw stock.

718,670. John H. Stevens, Newark, N. J. Assignor to Celluloid Co., New York, N. Y. **Pyroxylin compound.** A pyroxylin solution in a mixed ether obtained from the distillation of a mixture of alcohols with sulphuric acid.

718,692. Friedrich Breyer, Kogel, near Sieghartskirchen, Austria-Hungary. Making **sugar from beets.** Lime is applied to the beet root chips sufficient to make the diffusion product alkaline at a temperature not above 50° C., effecting a partial diffusion and then drawing off the juice and adding another quantity of lime to the residue, diffusing at a higher temperature, defecating the product of diffusion at the temperature at which they leave the diffuser, decolorizing by lime at about 100° C., desalting the juice by char, boiling and filtration.

718,729. Henrik E. Rusager, Fredericksberg near Copenhagen, Denmark. Making **cement.** Grinds the raw material in a natural moist state to a fine powder, dissolves a constituent in water, mixes it with the rest to a sludge, regrinds, calcines to a clinker and pulverizes.

718,828. Andrew Dickey, Niagara Falls, N. W. **Tap hole plug.** Heats one end of a carbonaceous plug containing a hydrocarbon till it is charred, while excluding the heat from the other end which is thereby subjected to destructive distillation.

718,884. John F. Stacey, Nashville, Tenn. Assignor one-half to Thomas E. Matthews, same place. Making **gas.** Mixes atmospheric air with coal gas, 6 parts to 94 at 200° to 205° F. as the coal gas comes from the retort, and before scrubbing.

718,887. Benjamin Talbot, Leeds, England. **Making gas.** Spreads fresh coal on the surface of a bed of distilling coal the

top being maintained just at the burning point of carbon while it is uniformly raked and stirred over the surface and just enough air fed into the combustion zone together with steam to supply oxygen and prevent craters forming.

718,891. Edward G. Acheson, Niagara Falls, N. Y. **Reducing metallic oxides.** Mixes with the oxide a reducing agent in proper proportions to reduce the oxide and interposes a layer of refractory carbide between the mixture and the electrical conductor and passes a current.

718,827 Robert H. Gould, Surbitan, England. Assignor to Cesar Gustav Luis, London, England. **Recovering tin from scrap.** The scraps are made an anode in a vessel containing sea-water or brine and a carbon cathode whereby most of the tin is removed, then placing them in a second vessel with an iron cathode and a salt solution and separating tin by a current of electricity from the first vat.

JANUARY 27, 1903.

719,062. John N. Henderson, New Orleans, La. Assignor to Edward Cunningham, same place. **Boiler compound.** Mixes parched ground coffee 40, logwood extract 2, blood meal 1, and salt 3 pounds, well mixed.

719,014. Isidor Klimont, Vienna, Austria-Hungary. Assignor to Emanuel Kuhner and Son, same place. **Purifying fats.** Stirs in the melted fat a strong solution of soda, draws off the lye at the bottom, washes with water, adds a solution of calcium chloride, filters, and finally heats above the boiling-point of water and blows in carbon dioxide.

719,047. Willis J. Roussel, New Orleans, La. **Briquet.** Garbage soaked in hot crude petroleum 75 per cent., charcoal 15, and rosin 10 per cent., pressed hot into blocks for fuel.

719,048. Friedrich Runkel, Elberfeld, Germany. Assignor to Elberfeld Co., New York, N. Y. **Yellow azo dye.** Diazotized sulphanilic acid is combined with methylindol, forming yellowish brown powders soluble in water and ammonia, and dyeing wool yellow to orange.

719,049. As above. Diazotized *o*-toluidine is united with *a*-methylindol, forming a dye similar to 719,048.

719,073. William J. Ambruster, St. Louis, Mo. **Making pigment.** Barium hydroxide, barium chloride, zinc sulphate and an alkaline carbonate are mixed in aqueous solution and in molecular proportions and the precipitate separated for a paint.

719,074. August Beck, Gratz, Austria-Hungary. **Metal-cleaning compound.** Carbonates of soda and potash 55, caustic potash 4, green soap 3, and water 100 parts, are mixed and boiled. May be used for cleaning firearms.

719,113. Ludwig Hirt, Grevenbroich, Germany. Assignor

to Maschinenfabrik, Grevenbroich, same place. **White sugar from beets.** Concentrates and boils the juice to massecuite, crystallizes, purges and collects the first molasses, boils the same to produce second massecuite, crystallizes and purges to produce second sugar and final massecuite molasses, adds the seconds sugar to the concentrated beet juice and a portion of the first molasses to the first massecuite making trisucrate of lime from the final molasses, converting the trisucrate to monosucrate, and causing the calcium hydroxide produced by the decomposition of the trisucrate to act on the raw beet juice.

719,117. John A. Hunter, Bradford, Pa. **Making steel from cast-iron.** Cast-iron just below the fusing-point is treated with the gases evolved by a heated mixture of two parts nitric and three parts sulphuric acids.

719,132. William Payne, James H. Gillies, and August Gondolf, Orange, New South Wales, Australia. **Treating copper ores.** Roasts to an oxide, saturates with ferrous sulphate or chloride, adds ferrous sulphide, roasts again and leaches the hot ore.

719,174. Richard E. Berthold, New York. **Self-igniting mantle.** An incandescent mantle provided with a pellet of material, and having strips of rhodium chloride secured to said mantle and leading to said pellet.

719,190. Samuel T. Coffin, Attica, Ind. **Rust-preventing and -removing composition.** Pulverized pumice 1, beeswax 2, sperm oil 3, and beef tallow 4 parts.

719,197. Lewis Crabtree, Newark, N. J. **Vitrifiable photographic decorations.** Mineral colors are mixed with glycerin and gelatin to form a color mass which is applied to a carrying medium as paper and made sensitive to light by potassium bichromate or its equivalent, then exposed under a negative, and the face placed in contact with the article to be decorated, the paper or other carrying medium removed by the action of hot water which at the same time washes out the soluble parts of the coating leaving the insoluble parts of the picture, and finally firing.

719,207. Charles H. Gage, Denver, Colorado. **Obtaining gold and silver, etc.,** from argillaceous and alkaline ores. Agitates the ore in a bath of hydrocyanic acid, then adds potassium cyanide till chemical action ceases, filters and passes through a bed of charcoal containing iron sulphate, which is in an electric circuit of high amperage and low voltage to deposit the metals.

719,216. Ernst Rentschel, Muskegon, Mich. **Digester lining.** Portland cement and crushed fire-brick or quartz 100 each, litharge and glycerin 200 each, and sodium silicate 50 parts by weight.

719,273. Zebulen B. Stuart, Los Angeles, Cal. **Apparatus for treating ore.** A tank provided with a mechanical stirrer

and an air compressor adapted to force air through the contents of the tank and circulate the same.

719,274. **As above** and for applying the apparatus to the extraction of precious metals in connection with aqueous solutions of cyanides.

719,320, William J. Foster, Darlaston, England. **Introducing carbon, etc., into blast-furnaces.** The carbon is first heated in a retort to about 1000° F. and blown hot through the tuyeres into the melting zone.

719,332. John B. F. Herreshoff, Brooklyn, N. Y. **Making sulphuric anhydride.** A stream of mixed sulphurous acid gas and air is heated and brought in contact with sufficient catalytic material to partially convert it to sulphuric anhydride, remove the mixture from the catalytic material and cool it, then bring it again in contact with the catalytic material to complete the conversion into sulphuric anhydride.

719,333. **As above.** Apparatus for carrying out the above process. Alternate tanks and coolers, the tanks filled with catalytic material and connected into a series with the coolers by pipes through which the mixed gases flow.

719,360. Otto Oppelt, New Albany, Ind. Assignor one-half to Peyton N. Clarke, Louisville, Ky., and John H. Stotsenburg, New Albany, Ind. **Gas process.** Heats Devonian bituminous shale to effect destructive distillation, drives off the hydrocarbons, renders the shale porous, cokes the oil therein, and charges the shale with sufficient heat to decompose superheated steam which is injected on the hot shale, making water-gas that is mixed with the hydrocarbons already liberated.

FEBRUARY 3, 1903.

719,415. Wm. J. Armbruster, St. Louis, Mo. **Making pigment.** Solutions of zinc sulphate, sodium carbonate and barium sulphide are mixed to form a pigment consisting of barium sulphate 233, zinc sulphide 97, and barium carbonate 197 parts by weight.

719,488. George Mitchell, Naco, Ariz. **Converting copper matte to copper.** Molten matte is charged into a converter and pure melted silica is fed to the matte while blown to metallic copper.

719,502. Melville G. Peters and James A. Shepardherd, Glasgow, Scotland. **Waterproof dressing.** Boiled linseed oil 30, petroleum spirit 3, lime-water 1, gum tragasol 10, coloring-matter 3 parts, and a drier.

719,555. William Beckers, New York, N. Y. **Acid mordant.** The liquid drawn from vegetables in pickling them with salt under pressure is concentrated to 20° to 30° Bé and filtered and may be used as a mordant for dyes. WM. H. SEAMAN.

// REVIEW OF AMERICAN CHEMICAL RESEARCH.

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WILLIAM A. NOYES, Editor.

GENERAL AND PHYSICAL CHEMISTRY.

Determination of Vapor Densities in an Electric Furnace. BY W. NERNST. *Trans. Am. Electrochemical Soc.*, Vol. III (1903).—The author describes a resistance furnace formed of an iridium tube, through the walls of which a current of 350 amperes is passed, heating it up to between 2000° and 2200° C. The bulb with capillary tube is also of iridium, shaped after a Meyer vapor-density apparatus. Its capacity is 5 cc. The temperature is measured by comparison with a small, incandescent filament. The accuracy was tested by volatilizing mercury, whose vapor is monatomic, and for whose molecular weight at 2000° was found 200 and 204. Water, sodium chloride and potassium chloride showed little dissociation at 2000°; carbonic acid gas gave a molecular weight of 44.1, 42.0, 41.9, which shows much less dissociation than was anticipated, but the measurement was made in presence of air in excess. J. W. RICHARDS.

An Experimental Study of Some Electrode Effects. BY H. M. TORY AND H. T. BARNES. *Trans. Am. Electrochemical Soc.*, Vol. III (1903).—Measurements were made of the potential differences of a large number of metals, in pure water free from air, as against the same metal in water charged with either air, oxygen or hydrogen. As a rule, the oxygen-charged acted the same as the air-charged water. The electrode in the gas-charged water was positive to that in the gas-free water in all cases where oxygen was used, but often negative when hydrogen was used. The principal results are as follows, the E. M. F. being in volts:

	Air-charged to air-free.	H-charged to air-free.
Aluminum	0.74 to 0.80	0.
Cadmium	0.125	—0.036
Carbon filament	0.092	—0.175
Copper	0.141	0.
Gold	0.170	0.
Iron	0.284 to 0.240	0.

	Air-charged to air-free.	H-charged to air-free.
Lead	0.074	0.
Magnesium	0.020	—0.206
Mercury	0.068	0.
Nickel	0.151	—0.151
Palladium	0.205	—0.640
Platinum	0.212 to 0.226	—0.445 to +0.308
Silver	0.105	+0.082
Tin	0.270	0.
Zinc	0.380	+0.181

Tests of one metal in one gas against another metal in another gas (all in aqueous solution) gave numerical results corresponding with what would be calculated from above data.

J. W. RICHARDS.

The Electrolysis of Water. BY J. W. RICHARDS AND W. S. LANDIS. *Trans. Am. Electrochemical Soc.*, Vol. III (1903).—Attempts were made to electrolyze dilute sulphuric acid in closed glass tubes and where the tubes was inelastic and would not explode, no current could be sent through with a potential of 3.5 volts. On breaking the seal, the current flowed from 0.3 volt upwards. Distilled water, boiled in a platinum dish, allowed no current to pass, but several micro-amperes passed as soon as oxyhydrogen gas was bubbled into it. A calorimetric experiment was made, measuring the watt-energy of the current which was setting free oxygen and hydrogen, and also the sensible heat generated in the electrolyte. The difference between the two amounted to an absorption of 1.5 joules per coulomb of electricity passing, or 1.51 volts as the voltage absorbed in decomposition. Under the microscope, gas was seen to form on the cathode at voltages down to 1.50, but not at 1.45. With a cell 8.75 meters long, and 0.1 per cent. sulphuric acid, the current passing from 0.3 to 3.25 volts, followed Ohm's law within the errors of the experiment, without disengagement of gas. The authors explain this by the fact that depolarization, *i. e.*, re-formation of water, by dissolved hydrogen takes place, for such feeble currents, as fast as decomposition, and that in that case, as in refining copper, no voltage is absorbed in decomposition, and the current obeys Ohm's law. Ohm's law gives the maximum current which can pass, if depolarization is complete. If depolarization is not complete, Ohm's law applies only to the portion of the current which is accounted for by depolarization ; the rest of the current causes ultimate decomposition, with an absorption of 1.5 joules of energy for every coulomb passing. J. W. RICHARDS.

Note on Electrical Endosmose. BY W. D. BANCROFT. *Trans. Am. Electrochemical Soc.*, Vol. III (1903).—The endosmose of common salt through a porous diaphragm was largely prevented by placing the salt solution in a porous cup, placing a platinum spiral in the bottom, and dipping the cup just beneath the surface of a caustic soda solution, the cathode being underneath the

bottom of the cup. This made a plane diaphragm of the bottom of the cup, and with this arrangement no chloride could be found in the cathode chamber after running forty minutes (2 ampere-hours). The author suggests that with proper arrangement of diaphragms the Hargreaves-Bird process could probably be run without steam, depending only on the water coming through the diaphragm by electrical endosmose. J. W. RICHARDS.

Thermo-Electromotive Force without Difference of Temperature. BY H. S. CARHART. *Trans. Am. Electrochemical Soc.*, Vol. III (1903).—When an electric circuit is composed of two or more metals, the thermo-electromotive force integrated around the circuit vanishes when the whole circuit is at one temperature. When the circuit is partly metallic and partly electrolytic, the author contends that the case is quite different, that changes in the electrolyte tend to limit the duration of the current, that the device as a thermal engine is self-limiting. A concentration cell can thus convert some of the equally diffused heat of its surroundings into electric energy, but it cannot do so continuously and can repeat the process only by having the cycle of operations reversed. The author then imagines a concentration cell carried through a complete Carnot's cycle, and finds that when brought back to its initial condition, work has been done at the expense of the energy of the surroundings. Any voltaic cell with a positive temperature coefficient converts absorbed heat into electric energy. The conclusions are true only if the foregoing premise is true, and if the chemical reactions in the cell are ignored. J. W. RICHARDS.

Concentration Changes in the Electrolysis of Brine. BY W. H. WALKER. *Trans. Am. Electrochemical Soc.*, Vol. III (1903).—A study of these changes in the light of the relative velocities of the sodium and chlorine ions. But, as soon as any sodium hydroxide has been formed, hydroxyl ions commence to take part in transporting the current with a velocity 2.6 times that of the chlorine ions. Therefore, while at the beginning, 65 per cent. of the salt decomposed comes from the cathode compartment, this proportion increases towards 85 per cent. as the electrolysis proceeds. This is leaving out of consideration the effect of diffusion through the partition. Electrical endosmose through the partition may also have some effect. J. W. RICHARDS.

ANALYTICAL CHEMISTRY.

The Estimation of Copper in Ores, Mattes, Etc. BY O. H. PACKER. *Electrical Review*, **42**, 374–376.—Exact details are given for carrying out the "aluminum strip" cyanide method, which the author believes is sufficiently accurate for all commercial work and the best method for the ordinary analyst.

The use of potassium hydroxide for neutralizing the excess of acid before adding the ammonia, and titration to a blue or pink end reaction, give the most satisfactory results.

B. S. CUSHMAN.

Constant Voltage and Constant Current Separations. BY W. D. BANCROFT. *Trans. Am. Electrochemical Soc.*, Vol. III (1903).—The paper contains tables of the order of deposition of the metals and hydrogen from various solutions, using a constant voltage and increasing current density (by bringing electrodes closer together), or constant current density and increasing voltage. Separations of Ag, Hg, Cu, Bi, Fe, Ni and Cd from various other metals are given. If hydrogen lies between two metals, they can be separated by a constant current method ; if not, then regulation of the voltage is necessary. There are three exceptions to this statement, *viz.*, those of copper from nickel in oxalate solutions, copper from cadmium in acid solutions and silver from cadmium in cyanide solution. All three should be constant current methods, yet all three require regulation of the voltage.

J. W. RICHARDS.

Detection of Small Percentages of Gas in Mine Air. BY J. T. BEARD. *Mines and Minerals*, May, 1903.—Description of a safety-lamp, inside the gauze of which are stretched horizontal strands of thin platinum wire, at different heights, directly above the flame. Gas makes the flame burn higher, and renders the platinum wires incandescent to varying heights, according to the proportion of gas present. A single strand fitted inside an ordinary safety-lamp, at such distance above the flame as the fire-boss may judge the danger line for a given mine, will show the workman when the gas conditions in which he is working are becoming dangerous.

J. W. RICHARDS.

METALLURGICAL CHEMISTRY.

The Schwartz Melting and Refining Furnace. BY E. H. SCHWARTZ. *Iron Age*, April 9, 1903 (paper read before Philadelphia Foundrymen's Association).—Copper, bronze or brass can be melted in this furnace with 1 gallon of fuel oil per 100 pounds of melted metal. The cost of maintenance of lining, etc., is 25 cents per ton of metal melted. Oxidation loss is low ; pure copper lost 0.2 per cent. Oxidizing, neutral, or reducing flame can be obtained as desired. There are no crucibles, coal or ashes, and from 400 to 1500 pounds of metal can be melted per hour. Soft steel scrap, 10 parts, and pig-iron, 90 parts, melt down to a strong "semi-steel" without any increase in sulphur or phosphorus. Steel charges, consisting of 40 per cent. low phosphorus pig and 90 per cent. soft-steel scrap, have been run in one hour and fifty minutes for a 1200-pound charge, making

0.40 per cent. carbon steel for castings. Capacities up to 6000 pounds per heat are being made. J. W. RICHARDS.

Coal Mines and Zinc Works at La Salle, Ill. BY A. DINSMORE. *Mines and Minerals*, April, 1903.—A very readable account of the mining plant at La Salle shaft, and of the large Matthiessen-Hegeler Zinc Works. J. W. RICHARDS.

The Present Oil Solution in Colorado. BY A. LAKES. *Mines and Minerals*, April, 1903.—An illustrated account of the present condition and prospects of the Colorado oil fields.

J. W. RICHARDS.

The Effect of Smoke and Gas Upon Vegetation. BY W. A. BUCKOUT. *Mines and Minerals*, May, 1903 (*Bull. Penn. Agricultural Expt. Sta.*).—A good resumé of present information on the subject. The necessity of general laws governing the amounts of gas permitted to escape from industrial establishments is emphasized. J. W. RICHARDS.

The Electric Reduction of Iron Ores and Manufacture of Steel. BY L. SIMPSON. *Electrochemical Industry*, April, 1903.—Under favorable conditions, water-power can be *produced* (not purchased) at $4 per horse-power year. The steel produced is at least equal to, if not superior to, the best steel made by other processes. According to data in the writer's possession, steel ingots can be made by electrical methods, in certain parts of Canada, at $10.61 per ton. J. W. RICHARDS.

The Cupola and Its Management. BY R. BUCHANAN. *Eng. Mag.*, April, 1903.—The short, wide cupola of thirty-years ago has largely given place to a different type; the height has been increased, the diameter for a given capacity diminished, and increased pressure of blast used. This has resulted in faster melting and decreased consumption of coke. Solid bottoms are in almost universal use in Great Britain, the drop bottom is almost the only pattern seen in the United States; the latter type has the greater number of advantages. The linings are usually firebrick or other siliceous material, but a neutral lining would be an improvement, if it could be found. The coke used should be high in fixed carbon; bye-product coke is equal to bee-hive oven-coke in everything but appearance. Low phosphorus iron requires a greater quantity of fuel to melt it than high phosphorus; 7.5 to 8 pounds of iron, melted per pound of coke, is satisfactory work. As to the metal, phosphorus may be as high as 1.5 per cent. in light castings where appearance rather than strength is desired, and should be as low as 0.20 in heavy castings of the highest quality; silicon may similarly vary from 3.0 to 1.20 per cent., manganese may reach 1 per cent., sulphur should not be above 0.1, and combined carbon up to 0.60 per cent. In one melting,

silicon will decrease about 0.25, manganese 0.1, phosphorus remain unchanged, and sulphur increase 0.038 per cent. High temperature makes fluid iron, fluid slag, stronger iron, and less absorption of sulphur; if iron cools in contact with slag it will absorb the greater part of the sulphur in it. The combined area of tuyeres should not exceed one-tenth the area of the cupola at the melting zone. Blast is used at 4 to 16 ounces pressure; dense, hard coke needs the higher pressures. The melting zone seldom extends over 36 inches above the highest tuyeres. The proper flame from the stack should be of a bluish pink color, and have a ragged and torn appearance; a whitish yellow flame shows that the coke charges are too great. Limestone is the flux generally used, but fluorspar is much recommended, or rather a mixture of the two. Fluorspar eliminates some sulphur, but no phosphorus. No ladle holding over half a ton should be without screw gear. Sulky ladles are often used. It seldom pays to recover iron shot from the foundry dirt. J. W. RICHARDS.

Open-Hearth Steel Production in 1902. *Eng. Min. J.*, April 18, 1903 (*Bulletin American Iron and Steel Association*).—The total production in the United States was 5,687,729 gross tons, an increase of over 22 per cent. over 1901. Pennsylvania produced nearly four-fifths of the whole. One-fifth of the whole was acid steel, four-fifths basic. 367,879 tons of open-hearth steel castings were made, of which 70 per cent. was acid steel.

J. W. RICHARDS.

The Taylor-White Process of Treating Tool Steel. Report of Committee. *J. Franklin Inst.*, February, 1903.—The tool steel treated by this process contains chromium, at least 0.5 per cent., and at least 1 per cent. of either tungsten or molybdenum; the carbon may be 0.85 to 2.00 per cent. All these self-hardening steels deteriorate, if heated above 1575° F., and break down rapidly if heated to 1675° F., but above this point they regain their properties, and may be heated up to 1900° F. and be all the harder for it after cooling. The tool, after forging, is heated gradually in a coke furnace till it becomes incandescent and would crumble if tapped with a rod. It is withdrawn and plunged at once into a bath of lead kept at a standard temperature by comparison with the light of a standardized incandescent lamp seen through colored glass. This gives uniformly good tools every time. After cooling in the bath, it is taken out and cooled in air. Tool steel thus treated is 3.5 times as efficient as the best untreated steel, on hammered forgings, and 1.3 times on cast-iron. Such tools will work at a red heat, visible in ordinary daylight, and in one case examined, the tool retained its edge perfectly after twenty minutes of such use, the original grinding marks not being obliterated. The committee recommended the award of the Elliott-Cresson gold medal to the inventors of the process. J. W. RICHARDS.

A Study of the Relations between the Micro-Structure, the Heat Treatment and the Physical Properties of Axle Steel. BY H. FAY, A. W. HIGGINS AND F. W. COBURN. *Tech. Quarterly*, March, 1903.—The steel used contained 0.41 carbon, 0.58 manganese, 0.023 silicon, 0.034 sulphur, 0.037 phosphorus, it was the ordinary "machinery steel" of the Midvale Steel Co., and was used in bars 18 inches long, by 1.5 inches diameter. The bars were heated in an electrically heated muffle, and the temperatures determined by a thermo-electric pyrometer. The critical points were first determined, being a short halt (10 seconds) at 745° and a long halt (160 seconds) at 670° C. For mechanical tests, the central part was turned down to 1 inch diameter, for a length of 10 inches. Tests were made by heating the bars up to different temperatures for different times, and cooling either slowly in the furnace or rapidly in air. The original steel was stronger than any of the treated specimens; it had been worked through the interval 1000° to 745°, during which crystallization takes place on slow cooling. Since none of the tests made improved the steel, it is needless to repeat the results, as they are only of negative value. J. W. RICHARDS.

The Constitution and Thermal Treatment of Steel. BY H. M. HOWE. *Metallographist*, April, 1903 (reprinted from 1902 edition of *Encyc. Britannica*).—A concise review of the present views of the constitution of iron-carbon alloys, and the explanation they give of the changes in properties caused by heat treatment. The unfortunate designation of *eutectic* is retained for *pearlyte*, without any explanation of why the misnomer is applied to it, and in what respects it differs from a real eutectic.

J. W. RICHARDS.

The Rolling and Structure of Steel Rails. BY P. H. DUDLEY. *Metallographist*, April, 1903.—A long review of the relation of micro-structure to the temperature at which the rails are rolled and finished. Excellent wearing qualities can be obtained by cold working, but this must be done with due regard to the elastic limits of the material. J. W. RICHARDS.

Some Unusual Crystals of Cast-Iron. BY J. E. JOHNSON, JR. *Metallographist*, January, 1903.—Photographs and analyses of large "crystals" of iron taken out of the bottom of a blast-furnace after a three-year run. They contained 6.08 graphitic C, 0.60 combined C, 0.47 Si, 0.22 S, 0.89 Mn, 0.83 P. The crystals were covered by tightly adherent plates of graphite. Professor Howe points out in a *Postscript* that these are not crystals of iron, properly so-called, but that the mass breaks along the cleavage planes of the unusually large, graphite crystals, just as granite containing much mica cleaves along the sheets of mica. The mass is, therefore, cast-iron with unusually large, graphite

crystals intermixed through it, like mica in a granite or cementite in spiegeleisen. J. W. RICHARDS.

On the Simultaneous Presence of Ferrite and Cementite in Steel. BY E. F. LANGE. *Metallographist*, January, 1903.—Mr. Lange notes that in annealed steel castings which he manufactures, containing approximately 0.38 C, 0.25 Si, 0.70 Mn, 0.03 S and 0.05 P, the microscopic structure often consists of structurally free cementite and ferrite, and contains absolutely no pearlyte. The section shows ferrite crystals throughout which are scattered little balls of segregated cementite, evidently occupying areas where pearlyte has been. It appears that maintaining the castings at a particular temperature somewhere above 700° determines the resolution of the pearlyte and the segregation of the cementite. Very slow cooling through the range 700° to 600° causes a similar effect, though not so marked.

J. W. RICHARDS.

Chill Rolls. BY B. E. V. LUTY. *Iron Age*, April 23 and 30, 1903.—A long article on the making and life of chill rolls, discussing why they break, the heat strains in them, the casting strains, etc. J. W. RICHARDS.

Preservation of Structural Steel in a New York Building. *Eng. Rec.*, April 18, 1903.—This is an extract from an official report on the condition of the steel framework of the Pabst Building, which had been erected only four years, when it was taken down to make room for a larger building. According to specifications, all the work was cleaned and given one coat of boiled linseed oil before leaving the shops; all pins, pin holes and machined parts were to be coated with pure white lead and tallow. All surfaces were to be painted before being riveted together. On taking down, the expanded metal and partitions were badly rusted throughout the building; the patent plaster seemed to have accelerated the rusting. In the basement floor, the ceiling rods had rusted away and the arch centering was more or less rusted on the exposed sides. In the part over the refrigerator, in the sub-basement vault, the wire cloth was almost completely gone and the ceiling was ready to fall almost by its own weight. The concrete floor arches at this point were not affected and remained strong and durable. The interior beams, girders and columns above the first floor were, as a rule, free from corrosion except for little patches of rust. The cast-iron columns in the basement and sub-basement were in excellent preservation, although the girders adjacent were rusted. All the unpainted work in the building was more or less rusted. The facts indicate that painting is efficient except in damp walls below the first story, where the members should be thoroughly imbedded in concrete, and that cast-iron withstands rust better than steel.

J. W. RICHARDS.

Corrosion of Metals by Electrolysis. BY A. A. KNUDSON. *Trans. Am. Electrochemical Soc.*, Vol. III (1903).—A discussion of the corrosion caused to water-mains and underground iron structures by stray electric currents. Measurements in lower New York and Brooklyn showed currents up to 70 amperes passing through the street mains, and back and forward to Brooklyn across the two steel bridges. The integrity of the steel anchorages of the Brooklyn bridge on the New York side and of the new bridge on the Brooklyn side is thereby endangered. It was pointed out by Mr. Hering, in the discussion, that blocks of zinc attached electrically to the anchorages, or to any iron structure embedded in moist soil, would act as a protection against corrosion.

J. W. RICHARDS.

The Protective Action of Zinc Chloride on Metallic Iron. BY C. J. REED. *Trans. Am. Electrochemical Soc.*, Vol. III (1903).—The author calls attention to the fact that strong zinc chloride solution, after being boiled with zinc, has no corrosive or rusting effect, but rather a protective effect, on bright metallic iron, although the solutions react acid to litmus. This fact seems to show that chlorine or hydrogen ions are not active agents in causing iron to rust. J. W. RICHARDS.

The Pich Process of Brazing Cast-Iron. *Iron Age*, April 16, 1903 (paper read before American Society of Mechanical Engineers).—A compound called ferro-fix, whose chief ingredient is copper oxide, is mixed with a liquid and applied to the place to be brazed. It is then heated to 1800° F., a flux, such as borax, is applied, and spelter is placed on the joint. The ferro-fix burns out the carbon and the spelter permeates the metal and takes the place of the carbon, uniting with the copper to form a brass. The brazed casting is as strong as the original. There is no limit to the size of casting which can be treated.

J. W. RICHARDS.

Ore Deposits at Butte, Montana. BY W. H. WEED. *Eng. Min. J.*, April 18, 1903 (*from Bull. No. 213, U. S. Geol. Surv.*).—An expert report on the present status of the mineral deposits at Butte, and their probable developments. The average ores contain 55 per cent. silica, 16 per cent. iron. About 15 per cent. of the ore is first-class, averaging 12 per cent. copper; the rest carries 4.8 per cent. copper, and is treated in concentrating mills, producing a concentrate carrying 18 per cent. of copper and but 15 to 20 per cent. silica. The ores carry $2^1/_4$ cents of gold to each pound of copper, and about 2 cents worth of silver. The total output has been 31,000,000 tons, averaging 5 per cent. copper. Much arsenic (and antimony) is present, the chalcocite having decreased in the veins since 1900 until it is nearly equalled by enargite. The crude copper carries $2^1/_8$ ounces of tellurium per ton. J. W. RICHARDS.

Treatment of Lake Copper. By J. B. Cooper. *Mines and Minerals*, May, 1903 (paper read before the Lake Superior Institute).—The first furnace to smelt Lake Superior copper in place was in 1846, when Prof. Jas. T. Hodge built and ran a furnace on the Gratiot River. The rock contained at least 20 per cent. copper, and the net result was only 3.5 per cent. extracted; after two runs the furnace was abandoned. A brief chonological sketch is then given of all the works built to treat Lake Superior copper. J. W. Richards.

The Matting of Ores at Leadville and Robinson, Colo. By C. H. Doolittle. *Eng. Min. J.*, April 11, 1903.—The tonnage of a furnace is due both to the physical and chemical condition of the ores treated. The Leadville ores are naturally fine, and sometimes the flue dust and slimes amount to one-tenth of the ore. Flue dust was bricked and returned. The ore furnace smelted 75 tons of ore per day, the average slag being 36 SiO_2, 36 FeO, 7 CaO, 5 ZnO. The average cost was $3.645 per ton of ore. The ore carried less than 2 per cent. copper, which was collected as matte. At the Robinson smelter only traces of copper were present in the ore, so that raw pyrite and pyrrhotite was charged plentifully and the precious metals collected in an iron matte, concentrating 30 to 1. The small amount of lead present was about half volatilized, the zinc entirely. One furnace would smelt 125 tons of ore, with 25 tons of limestone and 55 tons of slags, in twenty-four hours, using 13.5 per cent. of fuel.

J. W. Richards.

Notes on Modern Electrolytic Copper Refining. By T. Ulke. *Trans. Am. Electrochemical Soc.*, Vol. III (1903).—The solutions contain not less than 12 per cent. and not over 20 per cent. of blue vitriol, and from 4 to 10 per cent. of free sulphuric acid. A small quantity of common salt or magnesium chloride, or, better, hydrochloric acid (300 cc. to a tank of solution) is always added upon commencing operations, to hinder any possible solution of silver and to prevent sprouting or brittleness of the cathode or starting sheets. The electrolyte works best at 40°–50° C., at which point it may be kept by the heating power of the current, when current densities as high as 40 to 50 amperes per square foot are used. The voltage is 0.1 to 0.4 volt between plates. The anode scrap ranges from 7 to 15 per cent. in multiple plants, and may reach 30 per cent. in series plants. About 1 to 3 per cent. of the copper dissolved is recovered as blue vitriol. The cathodes are run to 0.25 to 0.45 inch thick in series plants, and 0.5 to 0.75 inch in multiple plants. Electrolytic copper is now being made at the rate of 322,295 short tons yearly, of which 86 per cent. is produced in the United States. On an average, 18 horse-power are required to produce one ton per day, and the actual cost of producing commercial cathodes from 98 per cent.

blister copper anodes is $3 to $15 per ton. Statistics are given of the power, number of tanks, and output, etc., of all the copper refineries of the world. J. W. RICHARDS.

Effect of Superheated Steam upon the Tensile Strength of Alloys. BY J. L. HALL. *Metallographist*, January, 1903.—Experience has indicated that copper and some of its alloys have proven unreliable when subjected to the action of highly-superheated steam. The paper gives tests showing that bronze (composition not given) is made slightly weaker by being heated to 320° C., and cooled again, but its elongation is increased; *i. e.*, it is annealed. Tested at 320°, the tensile strength was reduced 60 per cent., and elongation increased considerably. The paper contains no data at all on the effects of superheated steam on any alloys, but only that of the *temperature* of superheated steam; the difference may be quite important. J. W. RICHARDS.

Electromotive Force of Alloys. BY W. D. BANCROFT. *Trans. Am. Electrochemical Soc.*, Vol. III (1903).—According to Ostwald, an alloy should show the potential of its weakest (*i. e.*, least electropositive) phase; there are, however, many deviations from this rule. By annealing the alloy just below the proper quadruple point until equilibrium is reached, constant results are obtained. Bronzes thus annealed and tested against tin in stannous chloride solution give eminently satisfactory results. Alloys with over 65 per cent. tin show no potential, whether annealed or not; alloys with 45 to 65 per cent. tin show potential against tin when annealed, and no difference when not annealed. The first set consists of mixtures of CuSn and Sn, the second of Cu_3Sn and CuSn when equilibrium is reached by proper annealing, but they contain free tin, if rapidly cooled.

J. W. RICHARDS.

The Production of a Black Color on Brass. BY E. S. SPERRY. *Metal Industry*, February, 1903.—The use of liver of sulphur, while satisfactory with silver, is unsatisfactory with brass, as the color is wanting in depth and tint, and if a thick coating is eventually obtained, it scales off easily. A solution of carbonate of copper in ammonia is now used, and is made as follows: Take a hot solution of copper sulphate, add strong solution of washing soda as long as a precipitate forms; let stand, and decant clear liquor. Repeat the washing with hot water six or eight times, leaving a thick, plastic, clean carbonate of copper. Then add ammonia till everything is redissolved. Boil the brass first in strong potash solution, to remove grease and oil, rinse, and dip in the copper solution heated to 150° to 175° F., until the required tint is produced. Rinse and dry in sawdust. If the brass surface is first made matt, as by scratch brushing, a dead-black is obtained. J. W. RICHARDS.

Zinc Deposits. By A. Lakes. *Mines and Minerals*, May, 1903.—A review of the geology of the zinc deposits in Wisconsin, Arkansas, Missouri and Tennessee. J. W. Richards.

The Zinc Mines at Ellenville, N. Y. By A. O. Ihlseng. *Eng. Min. J.*, April 25, 1903.—Lead is found abundantly on the surface, and is displaced by zinc blende associated with copper pyrites as depth is gained. The blende is in veinlets in quartz, overlaid by quartz crystals and a layer of chalcopyrite, the whole having a dip of 40°. Samples of the quartz show 20 to 30 per cent. zinc. At the 175-foot level, a large body of zinc and copper ore has been opened, the copper streak, 15 inches wide and carrying 15 per cent. copper, the zinc ore 5 feet wide. A concentrating mill will be in operation in August. J. W. Richards.

Notes on the Electro-Deposition of Nickel. By W. McA. Johnson. *Trans. Am. Electrochemical Soc.*, Vol. III (1903).—A hot solution has its advantages and disadvantages, but is not a *sine qua non* for getting good deposits. Since nickel must be deposited from an alkaline, neutral, or very slightly acid electrolyte, it necessarily takes a higher voltage to deposit than if a strongly acid bath could be used. A hot solution reduces resistance, allows high current density to be used, facilitates circulation, and also prevents the curling-up of the deposit. The cause of curling-up is the deposition of some nickel hydride, under considerable molecular stress. This strain is largely relieved by the annealing effect of a hot solution, say at 60° C. If the electrolyte is kept substantially gas-free, by allowing it to drip through a vacuum, the tendency of nickel to curl up is largely removed, and heavy platings may be obtained. This device is particularly useful for obtaining good starting sheets. J. W. Richards.

Progress in the Metallurgy of Nickel in 1902. By T. Ulke. *Eng. Min. J.*, April 25, 1903.—The attempt of Mr. Sjöestedt at S. S. Marie, Ontario, to roast Sudbury pyrrhotite ore carrying less than 25 per cent. sulphur, in Herreshoff furnaces, was commercially impracticable. The use of the roasted residue for making ferro nickel was also commercially unsuccesful. Plans and estimates have been prepared for a large custom nickel-copper smelting and refining works to be erected at S. S. Marie, with a daily capacity of 75 tons of refined copper, 7.5 tons electro nickel, and 2,000 to 5,000 oz. of precious metals. (The process to be used has already been described in these abstracts.) At Sudbury, the Mond plant has temporarily closed down, to make changes in the method of smelting with a view to using hot-blast and possibly pyritic smelting. The self-roasting of the ores has proven a failure, because of insufficient generation of heat. The article then gives items of progress in methods in England, by Mond, and in Germany by Borchers and others, and concludes with a

reference to the arthor's article in *Electrochemical Industry*, February, 1903, already abstracted. J. W. RICHARDS.

Development in the Nickel Industry at Sault Ste. Marie, Ontario, Canada. BY E. A. SJÖSTEDT. *Eng. Min. J.*, April 25, 1903.—Contradicts Ulke's statements (see above), by stating that the economical practicability of roasting the Sudbury nickeliferous pyrrhotite has been completely demonstrated, using roasters designed and patented by the writer, without extraneous heat. The roasted ore is briquetted ready to go to the blast-furnaces (when completed), there to be used to produce a nickeliferous pig-iron. The ore used is selected so as to contain a minimum amount of copper and gangue, the ore shipped containing 0.2 to 1.0 per cent. copper, about 3 per cent. nickel, 25 to 30 per cent. sulphur and 0.01 per cent. phosphorus. Analyses show the sulphur reduced to an average of 1.82 per cent. Allowing for the value of the SO_2 gas furnished the sulphite plant, the residue costs $1.54 per ton, and can be briquetted for an equal amount, making the net cost of the briquetted, roasted ore not over $3 per ton. By mixing these briquettes with twice their weight of sulphur-free iron ore, the sulphur in the charge will be reduced to nearly 0.6 per cent. which will allow the production of pig-iron fit for making nickel steel. J. W. RICHARDS.

Mining Methods on the Klondike. BY E. HAANEL. *Eng. Min. J.*, April 11, 1903 (from Report Dominion Superintendent of Mines, 1902).—A description of the gold dredges, steam shovels, wire-rope carriers, methods of shafting, drifting and hydraulicing now used in Alaska. J. W. RICHARDS.

Present Practice in Gold Dredging. BY R. H. POSTLETHWAITE. *Mines and Minerals*, May, 1903.—The double-lift system, *i. e.*, the dumping of the material dredged into a hopper, from which it is pumped up, together with an additional supply of water, into a sluice, is gradually being done away with. The coarse material is now usually lifted by a mechanical conveyer. A floating, self-contained pontoon has been now proved conclusively as the most satisfactory and cheapest system of dredging. Close-connected buckets are best only when working in very easy ground. The connecting pins are best of manganese steel working in manganese steel bushings, and allowed to turn in both bucket and link. Revolving screens are better than flat shaking screens. The material is run in a thin stream over cocoa matting covered with expanded metal, the shape of the latter causing the water to take a devious course, and keeping the matting free of everything but the heaviest black sand, and enabling it to catch all the gold. Cleaning up is done much more rapidly and easily than when using mercury; the mats are simply washed in a concentrate box, and the concentrates are then amalgamated. Suit-

able ground can be thus handled at the rate of 50,000 cubic yards per month, per dredge, at a cost not exceeding 5 cents per cubic yard. J. W. RICHARDS.

Recent Tests for Platinum and Palladium in the Ores of the Rambler Mine. BY W. C. KNIGHT. *Eng. Min. J.*, April 18, 1903.—A test upon five carloads of matte from the ores produced at this mine showed (in ounces per ton) gold 0.45, silver 7.40, platinum 1.05, palladium 3.15. The platinum values are persisting in the ores, not varying materially from those first found, and as the copper refiners are now extracting and paying for these rare metals, the mine may be literally called a palladium or platinum mine, since these exceed in value the gold and silver present. Both osmium and iridium have been identified in the ore and are being sought for in the slimes. J. W. RICHARDS.

Molybdenite—Its Occurrence, Concentration and Uses. BY J. W. WELLS. *Can. Mining Rev.*, May 30, 1903.—Pure molybdenite contains 60 per cent. Mo and 40 per cent. S. The Ontario mineral, freed from gangue, contains 58.56 Mo, 38.34 S, 0.79 Fe, and 0.32 SiO_2. It is a common mineral in Canada, being found associated with pyrite, pyrrhotite and chalcopyrite, and it is often rich in gold. A list of thirty-five known localities in Canada is given. Attempts were made, in the laboratory of the Kingston School of Mines, to concentrate the ore, but no commercial product could be obtained. By the Elmer oil concentration process the pyrite and smaller flakes of molybdenite were extracted, so that no clean product was obtained, and the layer flakes were lost. By hand jigging, a product containing molybdenite and black mica was obtained, from which most of the mica was removed by a Wetherill magnetic separator, giving a product with over 90 per cent. molybdenite. It is probable that the Hooper pneumatic jig, such as is used for flake graphite, would give a good separation. No standard method of concentration can be used on all molybdenite ores; they vary so much that each ore is a problem in itself. The principal use is for reduction to molybdenum and making of special steel; 3 to 4 per cent. is being used in armor plate and tool steel. The best molybdenum costs $1.82 per pound for 96 per cent. grade, and $1.25 per pound for 50 per cent. ferro-molybdenum. Ore carrying 50 per cent. of molybdenum and free from copper sells at $400 per ton. A bibliography of the subject is appended.

J. W. RICHARDS.

Note on Corrosion of Aluminum. BY J. A. STEINMETZ. *Trans. Am. Electrochemical Soc.*, Vol. III (1903).—Photographs of plates of aluminum-nickel alloy which had been on the yacht Defender four years. Steel rivets were used to fasten the plates to the framework of the yacht, and they were in contact with the

Tobin bronze sheathing which was immersed in the salt water. The consequence was a voltaic couple which caused such rapid corrosion that in four years the vessel had to be broken up. The trouble could have been avoided by using aluminum rivets and insulating the aluminum from the Tobin bronze.

J. W. RICHARDS.

Electrodeposition on Rotating Cathodes. BY J. G. ZIMMERMAN. *Trans. Am. Electrochemical Soc.*, Vol. III (1903).—The cathode was a brass tube $^7/_8$ inch in diameter, attached directly to the shaft of a small electric motor. *Copper:* With 700 revolutions (per minute) and a current density of 200 amperes (per square foot) good deposits were obtained up to 0.04 inch thickness. If the peripheral velocity is increased to 1000 feet per minute, the plating is smooth with a high polish to any desired thickness. *Nickel:* Deposits in a polished cathode, at 1000 revolutions from a neutral, double ammonium sulphate bath, through a wide range of current density, as a good, dull-white deposit. With a high current density and a solution which had become slightly acid by use, the deposit had a high polish. *Zinc:* While it is difficult to obtain trees or rough deposits of nickel, it is difficult to avoid getting them with zinc; there is also a strong tendency for zinc to deposit as sponge. The best zinc deposits were obtained by using a partition in the solution, to prevent it revolving with the cathode and so to increase the friction. This device had the same effect as using higher speeds of rotation. Good deposits were obtained up to 225 amperes per square foot. *Iron* was most satisfactorily deposited. *Lead* was deposited as a thin film with high polish, from a plumbate solution. *Antimony* precipitated to considerable thickness with a high polish from a tartrate solution, but it crumbled to dust on exposure to the atmosphere for a few days. *Silver* plated out fast with high polish from a cyanide solution.

In the discussion, the prevailing view was that the effects were produced by the increased circulation of the solution, rather than by mechanical friction. Mr. Heath mentioned a curious case of a spiral depression in the plating on a revolving sphere.

J. W. RICHARDS.

Notes on the Composition of Electroplating Solutions. BY N. S. KEITH. *Trans. Am. Electrochemical Soc.*, Vol. III (1903).—More of the metal being plated is always deposited on the cathode than is dissolved from the anodes, unless the latter are absolutely pure. As this is very seldom the case, the constitution of the electrolyte is progressively changed until it finally becomes unfit for use. The best way to overcome this difficulty is to intermittently remove a part of the solution, so that the part removed per day contains as much of the impurities as are contributed by the anodes per day. In this manner, the electro-

lyte is always somewhat impure, but never so impure as to interfere with the deposition of pure metal under the conditions prevailing. J. W. RICHARDS.

BIOLOGICAL CHEMISTRY.

The Effect of Alcohol and Alcoholic Fluids Upon the Excretion of Uric Acid in Man. BY R. H. CHITTENDEN (for S. P. BEEBE). *Am. J. Physiol.*, 9, XI.—Two kinds of experiments were tried: Metabolism experiments, covering from one to three weeks; and hourly experiments, in which the urine was collected each hour during the day. Alcohol in four forms was used: Absolute alcohol suitably diluted, whiskey, beer, and port wine. A fixed diet was eaten. The most decided effect was obtained by the use of beer and port wine. Here there was a marked increase in the output of uric acid, and a smaller increase in the excretion of nitrogen. With absolute alcohol and whiskey very little difference could be shown in the effects, which were slight. Since the amount of alcohol in the different experiments was very nearly the same, the larger effect of beer and wine must be due to something other than the alcohol they contain.

F. P. UNDERHILL.

The Relationship Between the Freezing-Point Depression and Specific Gravity of Urine, Under Varying Conditions of Metabolism, and Its Clinical Value in the Estimation of Sugar and Albumin. BY G. H. A. CLOWES. *Am. J. Physiol.*, 9, 319–344.—In normal urine the depression of the freezing-point is directly proportional to the specific gravity, and may be determined from the latter by multiplying the figures after the decimal point by 75. In pathological urines other than those containing sugar and albumin, the same tendency to maintain a constant proportion between the freezing-point and specific gravity may be observed, although within wider limits than in the case of normal urines. In cancer, typhoid fever, and other diseases in which the excretion of chlorides is extremely small, the effect exerted upon the freezing-point depression is not so great as might be expected from the removal of such a large proportion of the smaller ions. In diabetic urines, the quantity of sugar may be very readily estimated by determining the freezing-point of the urine in question, and calculating the theoretical lowering of the freezing-point from the specific gravity. The difference between these two quantities in degrees C., when multiplied by 6, gives a very close approximation of the actual percentage of sugar present. The quantity of albumin may be estimated by determining the specific gravity and the freezing-point in a urine to which a couple of drops of dilute acetic acid has been added, then boiling in order to precipitate the albumin, filtering and once more determining the specific gravity and freezing-point. The second specific gravity is reduced to the same ionic concen-

tration as the first, by multiplying its decimal portion by the freezing-point obtained after boiling. This calculated specific gravity in then subtracted from the original specific gravity determined before boiling, and the difference multiplied by the factor 400, which gives the percentage of albumin. In a urine containing both albumin and sugar, the former is first estimated by addition of acetic acid, as above, and the freezing-point and the specific gravity obtained after boiling are employed in the estimation of sugar.

F. P. UNDERHILL.

The Cause of the Greater Diuretic Action of Hyperisotonic Salt Solutions. BY TORALD SOLLMAN. *Am. J. Physiol.*, 9, XIII. —It is found that the diuretic effect of equimolecular salt solutions is (with a few exceptions) proportional to their osmotic pressure. It is shown that this is not sufficiently explained by the greater hydraemia. Experiments on excised kidneys show that hyperisotonic solutions increase, while hypotonic solutions decrease or arrest, the blood flow and urine filtration in excised and dead kidneys. The superior diuretic effect of hyperisotonic solutions is, therefore, at least in large part, purely physical, and is explained by the dehydration and shrinkage of the renal tissues, and the more rapid circulation which is thus produced. The diuretic effect of saline injection is also partly explained by the dilution and lessened viscidity of the blood, and the resulting quickened renal circulation.

F. P. UNDERHILL.

The Acidity of the Urine. BY OTTO FOLIN. *Am. J. Physiol.*, 9, 265–279.—This article discusses methods for the determination of the acidity of the urine; and recommends some modified methods for the total, mineral, and organic acidity of the urine.

F. P. UNDERHILL.

On Nucleic Acid. BY P. A. LEVENE. *Am. J. Physiol.*, 9, XVII.—Further investigation into the composition of nucleic acids of different origin resulted in the author improving the process of obtaining the pyrimidine bases so that no silver need be used in order to obtain thymine and cytosine. On decomposition of the acids of the spleen and pancreas, there were found three bases, namely, thymine, cytosine, and uracil. The acid derived from yeast yielded on hydrolysis only two of the bases, uracil and cytosine.

F. P. UNDERHILL.

On the Effects of Subcutaneous Injection of the Extract of the Suprarenal Capsule Upon the Blood Vessels of the Rabbits' Ear. BY S. J. MELTZER AND CLARA MELTZER. *Am. J. Physiol.*, 9, 252–262.—Subcutaneous injection of suprarenal extract exerts a distinct effect upon the blood vessels of the ear. In normal animals a large, distinctly poisonous dose causes blanching of the ears; a medium dose causes a moderate but distinct dilatation of the blood vessels. In rabbits, in which the vasomotor nerves

were cut on one side, a subcutaneous injection of a medium dose of adrenalin induced a distinct constriction of the vessels on the operated side and a dilatation on the unoperated side. Apparently adrenalin is but very little oxidized in the subcutaneous tissues.

F. P. UNDERHILL.

Differences of Potential Between Blood and Serum, and Between Normal and Laked Blood. BY G. N. STEWART. *Am. J. Physiol*, 9, 262–265.—Even after the action of such haemolytic agents as sapotoxin, in doses sufficient to produce marked liberation of electrolytes from the corpuscles, the differences of potential between laked and unlaked blood are very small. No definite differences could, in general, be made out between defibrinated blood or a blood sediment very rich in corpuscles, and the serum separated from it.

F. P. UNDERHILL.

Ureine. BY W. OVID MOOR. *Le Physiologiste Russe*, 2, 128–131.—By a method that cannot be given here, the author has succeeded in isolating a new substance from the urine to which the name "Ureine" has been given. Ureine is an organic liquid of a pale yellow color, of a slightly bitter taste, gives to the touch the impression of a fatty substance, produces on paper spots resembling fat spots, though not so markedly as spots produced by fat. Its specific gravity is about 1.065. Its quantity is about double that of urea. It is freely miscible in all proportions with water and alcohol, whether neutral, acid or alkaline in reaction; its own reaction is very slightly alkaline, almost neutral. It probably belongs to the group of alcohols of the aromatic series; at a temperature of about 80° Celsius, it splits into several bodies belonging to the class of aromatic oxy acids, and if heated to above 120° Celsius, it leaves behind pure carbon. It is this constituent of the urine, which is the cause of its specific odor. It is able to take up a large quantity of oxygen with great facility. Ureine is the long sought cause of those complex toxic symptoms, which have been designated by the collective name of uraemia. Rabbits weighing over one kilo have succumbed in 8-10 hours to 4-5 cubic centimeters of this poison showing symptoms resembling somewhat those of morphine poisoning.

F. P. UNDERHILL.

The Effect of Saline Injections, Diuretics, and Nephritic Poisons on the Chloride Content of the Urine of the Dog. BY TORALD SOLLMAN. *Am. J. Physiol.*, 9, XII.—The factors studied can be arranged in four classes:

Class I. Those which diminish the per cent. of chlorine (to about 0.020 per cent.), but which cause considerable diuresis and consequently an increase in the absolute quantity of chlorine: Intravenous injections of solutions of urea, glucose, alcohol, and sodium acetate, ferrocyanide, phosphate and sulphate.

Class II. Diminishing both the per cent. and the absolute amount of chlorine: Water, salt, starvation.

Class III. No effect upon the chlorine: Nephritic poisons, caffeine, phlorhizin, laking, degree of diuresis, and the quantity or concentration of the injected fluid.

Class IV. Increasing the per cent. of chlorine, if this has been previously low: Solutions of sodium nitrate, sulphocyanide, iodide, and presumably bromide.

The study of these factors shows that the essential cause of the diminished chloride-content of the urine is not an increased diuresis, nor the presence of a foreign salt, nor the dilution of the serum; but the only essential fact is a lowered per cent. of chlorine in the serum. F. P. UNDERHILL.

On the Pharmacological Action of Optical Isomers. BY ARTHUR R. CUSHNY. *Am. J. Physiol.*, 9, XIV.—These experiments were performed with laevo-hyoscyamine and the racemic form, atropine. It was found that these acted equally strongly on the terminations of the motor nerves in striated muscle in the frog, on the frog's heart muscle, and on the central nervous system in mammals, while atropine had a more stimulating action on the central nervous system of the frog. Hyoscyamine acted almost exactly twice as strongly as atropine on the nerve terminations in the salivary glands, heart, and pupil in mammals, from which it is inferred that the racemic atropine liberates the two optically active forms when dissolved, and that the dextro-hyoscyamine is practically devoid of action in these organs. It was found that laevo-hyoscyamine acts 12-16 times as strongly on the salivary secretion as dextro-hyoscyamine, and about 12-14 times as strongly on the terminations of the inhibitory cardiac fibers. The terminations of the nerves in the salivary glands, heart, and pupil can, therefore, differentiate between these optical isomers.

F. P. UNDERHILL.

The Toxicity of Tetra-Phosphorus Tri-Sulphide. BY A. E. THAYER AND C. G. L. WOLF. *J. Med. Research*, 9 (new series, 4), 191–216.—Inhalation of air, passed through tetra-phosphorus trisulphide in substance, has no appreciable influence upon the rabbit at room temperature. In the dog, P_4S_3 acts as a mild irritant upon the alimentary canal. This action is more pronounced in the intestine than in the stomach. It does not cause hemolysis, nor jaundice, nor the appearance in the urine of albumin, sugar, tyrosine, nor leucine. Consequently tetra-phosphorus tri-sulphide may be considered non-toxic in any ordinary circumstances.

F. P. UNDERHILL.

Upon the Plurality of Cytolysins in Normal Blood Sera. BY SIMON FLEXNER AND HIDEYO NOGUCHI. *J. Med. Research*, 9 (new series, 4), 257–270.—These experiments were undertaken

with the view of determining the existence in normal blood-sera of cytolysins for other cells than red and white corpuscles. Sera from warm and cold-blooded invertebrates—rattlesnake and dog—as well as from *necturus*, were chosen, and the results demonstrated the occurrence in them of solvents for a wide variety of cells. F. P. UNDERHILL.

IV. The Relation of Carbon Dioxide to Proteolysis in the Ripening of Cheddar Cheese. BY LUCIUS R. VAN SLYKE AND EDWIN B. HART. *Am. Chem. J.*, 30, 1–25.—The object of the work described in this paper was to ascertain the extent to which carbon dioxide is formed in American cheddar cheese during long periods of time in the process of ripening, and also to learn the nature of the chemical changes that give rise to the production of this gas. Two cheeses were used for this study. One was entirely normal, the other was made from milk containing chloroform and kept under antiseptic conditions. The investigation was continued thirty-two weeks, when a chemical study was made of the proteolytic end-products. In the normal cheese, carbon dioxide was given off continuously, though in decreasing quantities after about twenty weeks, and had not ceased at the end of thirty-two weeks. The total amount thus produced was 15.099 grams, equal to 0.5 per cent. of the fresh cheese. In the chloroformed cheese, the total amount of carbon dioxide produced was 0.205 gram, practically none being found after three weeks. In the normal cheese, the following end-products of proteolysis were found: Tyrosine, oxyphenylethylamine, arginine in traces, histidine, lysine, guanidine, putrescine in traces and ammonia. In the chloroformed cheese were found the same compounds, excepting oxyphenylethylamine, guanidine, and ammonia, but arginine was found in marked quantities for the first time in cheese. A consideration of the possible sources of carbon dioxide in the two cheeses indicates that, in the case of the chloroformed cheese, the carbon dioxide came from that present originally in the milk, and that found in the milk from the decomposition of the milk sugar before treatment with chloroform. In the case of the normal cheese, the carbon dioxide given off in its early age came largely from the decomposition of milk-sugar by lactic acid organisms, while a small amount was probably due to the carbon dioxide present in the milk, and to the respiration of living organisms present in the cheese. In the chloroformed cheese, the only active proteolytic agents were lactic acid, galactose, and rennet pepsin. Under the conditions of experimentation, these agents were able to form neither ammonia, nor secondary amido compounds with production of carbon dioxide. The presence of chloroform could not account for this lack of action. The results suggest that, in the normal cheese, there must have been some agent at work not present in the chloroformed cheese, and that this factor was of a biological character. F. P. UNDERHILL.

Synopsis of Experiments on the Transformation of Circulating Uric Acid in the Organism of Man and Animals. BY ALFRED C. CROFTAN. *N. Y. Med. Record*, **64**, 6–11.—The author shows that uric acid is normally transformed in the organism and that this destruction is carried on by the aid of unorganized "ferments" that the organs secrete. The muscles destroy most uric acid, next to the kidneys, then the liver, the spleen, and the blood. The old view that uric acid is an intermediary product between proteids and urea has been rehabilitated.

F. P. UNDERHILL.

On Secretion and Lymph-Flow. BY LAFAYETTE B. MENDEL (for HENRY C. THACHER). *Am. J. Physiol.*, 9, XV.—The experiments show that injections of secretin, free from albumose, cause an increased flow of lymph, somewhat richer in solids. No influence upon the blood pressure could be observed.

F. P. UNDERHILL.

The Influence of Quinic Acid on the Elimination of Uric Acid. BY W. A. TALTAVALL AND WILLIAM J. GIES. *Am. J. Physiol.*, 9, XVI.—The results of these experiments show that the output of uric acid in the urine of dogs is not materially affected by the administration of quinic acid. F. P. UNDERHILL.

Peptic Proteolysis in Acid Solutions of Equal Conductivity. BY WILLIAM J. GIES. *Am. J. Physiol.*, 9, XVI.—Numerous digestive experiments with various equidissociated acids and with fibrin as an indicator, have invariably given results lacking quantitative agreement. F. P. UNDERHILL.

INDUSTRIAL CHEMISTRY.

Cold Storage. BY H. T. GILPIN. *Journal of Society of Chemical Industry*, March 31, 1903, p. 346.—As a medium for absorbing and distributing cold, the author prefers calcium chloride brine. The reason why it has not come into general use to the exclusion of common salt is because it is, or has been, much more expensive in its cost, is more difficult to prepare and handle, and cannot be obtained everywhere like common salt. Calcium chloride has less corrosive action upon the pipes than common salt, especially when exposed to the air. The author states that it is a better conveyor of cold than any other salt with which he is acquainted, because, with a given freezing-point at a given temperature, its specific heat is higher, consequently less brine is necessary and less is required to be circulated than would be in all other media with which he has had experience. Most brines, other than calcium chloride, at their maximum density will freeze at about 7° below zero F., while calcium chloride brine will not freeze at 50° below zero F., hence

a less dense brine of calcium chloride can be made than any other, and give more conducting power per pound.

The following figures are proportions found most useful in making brine from the commercial fused calcium chloride, which already contains 25 per cent. of water; the figures represent the percentage of anhydrous calcium chloride:

Pounds of calcium chloride to 1 U. S. gallon of water.	Degrees salometer at 60° F.	Freezing-point. Degrees F.
2½	80	4
3	88	—2
3½	96	—9
4	104	—17
4½	112	—27
5	120	—39
5½	...	—54

The necessity for change of air in cold storage spaces is as important as in dwellings. For example, analyses of atmospheric air taken from different stores at different times of storage give varying proportions of carbonic dioxide, carbon monoxide, ammonia, sulphuretted hydrogen, and complex organic gases. It is not uncommon to see fungi growing on the walls in cold storage, even within ice which has been produced by condensation through imperfect iusulation.

Of two rooms having equal exposure and equal cooling and ventilating facilities, the one containing greater tonnage of produce will show a higher temperature, as all organized matter generates more or less heat. Experiments prove that nearly all fruit, vegetables and eggs are preserved best in a temperature just above their freezing-point. The agents which act as absorbents of gases and vapors, which help to retard the injurious effects to a certain degree, are quick-lime, lead acetate, ferrous sulphate, and "carbo ligni" (wood charcoal). S. P. SADTLER.

The Schroeder Contact Process of Sulphuric Acid Manufacture. BY DR. FRANZ MEYER AND GEORGE C. STOWE. *Jour. Soc. Chem. Ind.*, March 31, 1903, p. 348.—The Schroeder process in its present form uses a contact material described in U. S. Patents No. 636,924 and No. 636,925. In this mass, Schroeder replaces the insoluble bodies used heretofore as carriers for the platinum, as, for instance, asbestos, pumice stone, burnt clay, etc., by calcined soluble salts, principly sulphates, obtaining the following advantages:

1. The contact mass is easily regenerated, hence the kiln gases do not need to be purified as perfectly as if working with platinized, insoluble vehicles.

2. The calcined salt crusts are very porous, so that the contact mass made from them offers much less resistance to the gases passing through, than the tightly packed asbestos formerly used.

3. The catalytic action of the contact mass made from soluble salts is far superior to that of platinized, insoluble carriers and the

contents of the platinum in the contact mass, which was from 8 to 10 per cent. of the weight of the asbestos in the old Schroeder plants, has been decreased to 0.1 per cent. without reducing the efficiency of the contact material.

The mass is made by adding platinic chloride to a solution of soluble salt or salts which are not acted upon by sulphuric acid or decomposed at the maximum temperature of the reaction, about 600° C. The solution is evaporated and the residue ignited to drive off water of crystallization and decompose the platinum chloride. The salt mixture is granulated and is ready for use.

To prevent channelling, the contact tubes are no longer placed horizontal or even inclined, as at first, but are vertical and are divided into compartments to insure a thorough admixture throughout of the sulphurous gas with the air.

At present there are about twenty-three Schroeder plants built or building: Seven in Germany, two in Russia, one in Poland, one in Italy, two in France, one in Chili, one in Mexico, two in South Africa, and six in the United States. Some are using blende, some pyrites, some brimstone, and one a low grade gold ore.

Acid up to about 40 per cent. of free sulphuric anhydride can be made in the absorbers. If stronger acid is required, it must be made by distillation.

The advantage of the contact process is greater the stronger the acid made, the cost being the same per unit of sulphur for all strengths. For acids stronger than 60° B., it is cheaper than chambers; but for 50°, and perhaps 60° B., it has at present but little if any advantage. S. P. SADTLER.

Acetylene Dissolved in Acetone. BY R. S. HUTTON. *Electrochemical Industry*, April, 1903, p. 274.—In searching for a suitable liquid which might dissolve acetylene in such amount as to act as a reservoir for the gas, acetone was found to have great advantage. It dissolved twenty-four times its volume of acetylene at 15° C., at ordinary atmospheric pressure, and as the pressure increases its solubility also very considerably augments. The liquid has, moreover, the practical advantage of a comparatively high boiling-point (56° C.) and can be had as a common industrial product.

The solution has none of the dangerous explosive properties which it will be remembered have been ascribed to the liquefied gas. As the volume of acetone increases very largely by the solution of acetylene in it, space must always be left and to obviate danger it was thought best to fill all the space of the cylinders with porous material which should absorb the solution. Porous bricks and cements have been used with a low density and considerably porosity, up to 80 per cent., and these are found capable

of storing the solution of the gas under pressure up to 35 atmospheres without the least fear of explosion, although high pressures like these are not even approached in the apparatus used for commercial purposes. In these cylinders, the volume of gas is ten times the cylinder volume at normal pressure, and, using a pressure of ten atmospheres, the volume of gas stored becomes 100 times the volume of the cylinder. The use of acetylene in this form obviates many of the troubles adherent to the direct generation from carbide, but, of course, necessitates the use of suitable reducing valves to insure a constant pressure of gas from the charged cylinders. The loss of acetone is comparatively small. S. P. SADTLER.

Siloxicon. *Electrochemical Industry*, June, 1903, p. 358.—This is a new compound obtained in the electric furnace and patented recently by Acheson. It seems to contain various oxygen compounds of carbon and silicon whose formulas vary from Si_2C_2O to Si_7C_7O. The former compound may be considered as formed according to the equation: $2SiO_2+5C=Si_2C_2O+3CO$. The material is described as of a gray-green color, with a density of about 2.75. It is non-oxidizable, infusible, neutral, insoluble in molten metals, and unaffected by any acids, with the exception of hydrofluoric, which seems to act upon it very gradually. It promises to be of value as a refractory material for lining furnaces, for crucible manufacture, etc. S. P. SADTLER.

Canadian Chemical Industries. BY W. R. LANG, D. SC., Chairman's Address, Canadian Section, *Soc. Chem. Industry*, May 15, 1903.—The annual aggregate capacity of the completed and unfinished iron furnaces in the Dominion in 1901 was close to 1,000,000 gross tons. These plants are at Sault Ste. Marie, at Collingwood, Ontario, where the Gilchrist-Thomas basic steel process will be used, and at Sydney, Nova Scotia. The Dominion Iron and Steel Co., at the latter place, also operate by-product ovens and collect and utilize all the residuals.

Copper ores are abundant, but are not worked for refined copper, but the copper matte is exported to the United States to be refined. Its value in 1901 was $6,600,104. Nickel ores are worked extensively. Both the Mond and the Frasch processes are used in working up the matte. The value of the production in 1901 was $4,594,523. The Canadian branch of the Pittsburg Reduction Co. has aluminum works at Shawinigan Falls, near Quebec, and have an annual production in 1902 valued at $1,643,250. Both arsenic and antimony are produced in Canada, the former from arsenical pyrites (mispickel), the latter from stibnite. The gold production, which includes that from the Yukon and that from British Columbia, amounted in 1901 to $24,463,222.

Sulphuric acid, is manufactured mainly for the refining of the Canadian petroleum, but the Lake Superior Power Co. employs

the sulphur obtained in the smelting of nickeliferous ores in the manufacture of sulphite pulp. The destructive distillation of wood is beginning to be carried on extensively for the production of wood alcohol and acetic acid. Both of these products are now largely exported to Europe. As Canada possesses enormous supplies of wood, this industry should develop largely.

The soap industry of Canada is growing rapidly. In 1902 the value of the soap produced was approximately $3,000,000. Sulphate of ammonia is manufactured at the works of the Dominion Iron and Steel Co., Sydney, Nova Scotia, and supplied to dealers and others engaged in the fertilizer business. The Michigan Alkali Co. works up the ammoniacal liquors of Quebec, Ottowa and Toronto at the latter city. Sulphate of ammonia is also made in Montreal. The calcium carbide industry has also advanced very rapidly, the Canadian companies being the Willson Carbide Co., at St. Catharine's, Ontario, and the Ottawa Carbide Co. The Union Carbide Co., of Chicago, has contracted for a large amount of power for a new plant at Sault Ste. Marie for the manufacture of carbide, and another prospective company is the Shawinigan Carbide Co., of Shawinigan Falls, Quebec, the works of which are under construction. The Canadian branch of the Carborundum Co., manufactures both carborundum and artificial graphite under the Acheson patents, most of the former being exported to Scotland for finishing granite. The Portland cement industry has developed very greatly in the past few years, there being eight factories in Ontario, and one in Quebec. The combined capacity of these factories is 875,000 barrels per annum and the output in 1902 was 565,000 barrels with a value of $1,028,618. The fine deposits of gypsum found near Hillsborough, N. B., have given rise to a plaster industry amounting to 60,000 barrels per annum.

The refining of raw sugar, as imported from tropical countries and from the continent of Europe, and the production of beet sugar are both important industries and the latter particularly is developing rapidly. Four companies in Ontario, and one in the Northwestern Territory are now producing sugar from the beet, the combined capacity being 2650 tons of beets per day.

Both natural gas and petroleum are important products of the Dominion, the former being found in two well-defined areas, the Essex Co. field, and the Welland Co. field. The gas from the latter field is exported largely to the American side of the Niagara River to Buffalo, N. Y. The principal seat of the petroleum industry is in Ontario, in the counties of Kent and Lambton. The production of oil in 1901 was a little over 26,500,000 imperial gallons.

As timber is one of the chief natural products of the Dominion, Canada has naturally a very large wood-pulp industry. In 1901, some thirty-five factories reported wood-pulp valued at nearly

$2,000,000, beside that used directly for paper making. The total production for 1902 is thus given by the "Toronto Globe": Mechanical wood-pulp, 155,210 tons; sulphite pulp, 76,735 tons; soda pulp, 9,044 tons.

The world's supply of asbestos is for the most part obtained from Canada, and the Quebec deposits have proved to be the most profitable industry worked in the province. The production for 1901 amounted to 38,000 tons. S. P. SADTLER.

Conditions of Progress in Electrochemistry. BY J. W. RICHARDS. *Trans. Am. Electrochemical Soc.*, Vol. III (1902).—The speaker, in his presidential address before this society, classified the items of progress under: (1) Discovery of new facts; (2) clearer understanding of the laws correlating facts; (3) more rational theories of the why and the wherefore; (4) increasing application of the facts to the welfare of mankind; (5) increasing dissemination of scientific literature; (6) an increasing vision, on the part of the scientist, of the possibilities of scientific achievment. The author's conclusion regarding the publication of results obtained in industrial establishments is interesting; it is, that "when the research has achieved its financial purpose, the scientific results should be given to the world." The address contains the author's opinions on many other industrial and scientific questions. J. W. RICHARDS.

Solid Electrolyte Cells. BY A. L. MARSH. *Electrochemical Industry*, March, 1903.—A copper phosphide, Cu_3P_2, was prepared and mixed in small fragments with red phosphorus. This mixture was compressed between terminals of copper and zinc or copper and sodium, and the whole covered with oil. Another cell consisted of copper, metallic arsenic, and sodium. Electromotive forces up to 1.5 volts were found for the first, 0.8 volt for the second, and 0.3 volt for the third. Metallic arsenic and sodium pressed together, using copper wires for terminals, gave 1.2 volts. J. W. RICHARDS.

The Use of Pyroxylin in Electric Storage Batteries. BY E. A. SPERRY. *Trans. Am. Electrochemical Soc.*, Vol. III (1903).—This is a fabric, like cheese-cloth, first freed from all traces of soluble, starchy and oleagenous matter by successive boilings in pure water, then titrated by a mixture of 113 parts nitric acid to 150 parts pure sulphuric acid. The fiber is then washed, neutralized and made hygroscopic by using a small quantity of nitrobenzene in the last washing. As thus prepared, the material is always moist, does not explode and will not fire. The fabric is then wound tightly around the positive plate of the battery, where it remains unaffected by the charge or discharge, and by its elasticity keeps the active material in close contact with the plate and prevents it falling off. J. W. RICHARDS.

Ions and Electrons. By L. A. Parsons. *Trans. Am. Electrochemical Soc.*, Vol. III (1903).—A twenty-page review of the prevalent views regarding this subject. J. W. Richards.

Uniformity in Electrochemical Equivalents. By Carl Hering. *Trans. Am. Electrochemical Soc.*, Vol. III (1903)—A plea for using, by universal agreement, 96,540 coulombs as the "Faraday," and the electrochemical equivalent of silver as 0.001118 gram, until these values have been proved so far erroneous that an International Congress fixes on more accurate values for general use. Opinion was divided, in the discussion, as to the wisdom of thus fixing a value, as it would be the equivalent, for instance, of chemists having legalized atomic weights. J. W. Richards.

Influence of Impurities in Salt upon the Yield of Caustic Soda by the Amalgam Process. By J. W. Walker and C. S. Paterson. *Trans. Am. Electrochemical Soc.*, Vol. III (1903).—With pure salt, the percentage of sodium lost by recombination is in no case greater than 1.6 per cent. The common impurities in salt have a very slight influence on the yield, not over 2.5 per cent. Nickel caused great losses, 0.0002 per cent. in the solution causing 9.5 per cent. loss, and 0.006 per cent., 35.8 per cent. loss. Cobalt acts similarly. Iron added to solutions containing the ordinary traces of calcium and magnesium found in commercial salt, caused losses from 10 per cent., with 0.0003 per cent. iron, to 30 per cent. with 0.001 per cent. iron. Increasing the current, under the last conditions, increased the percentage loss. Magnesium had little effect, but calcium and nickel together caused losses up to 75 per cent., when 0.0008 per cent. nickel and 0.02 per cent. calcium were present. The authors believe that local galvanic action is the cause of the loss, for when iron is present, the amalgam showed signs of decomposing the solution as soon as the current is turned off; when nickel is present, the decomposition commences instantly and is very rapid. It is possible that the compound of nickel with magnesium or calcium may be more active in this respect than the amalgam of either metal alone. J. W. Richards.

Electrolytic Production of Metallic Compounds. By C. F. Burgess and C. Hambuechen. *Trans. Am. Electrochemical Soc.*, Vol. III (1903).—In producing a metallic sulphate, nitrate, or chloride, it is cheaper to obtain the SO_4 or Cl or NO_3 from a sodium salt than from the acid. The metal is to be used as a soluble anode, and the cost of power is usually insignificant compared with the difference between the cost of the acid and that of the sodium salt. Furthermore, valuable cathode products, such as sodium hydroxide, are obtainable by the electrolytic method. Such metallic compounds may be soluble or insoluble. Using

lead in sodium nitrate, it is important to avoid formation of nitrites, or ammonia, or deposition of lead at the cathode, or formation of basic lead salts at the anode. Clean corrosion of the anode at 100 per cent. efficiency is dependent principally on maintaining an acidity of 0.1 normal nitric acid in the vicinity of the anode, with which perfect corrosion can be obtained with current densities up to 20 amperes per square foot. Similar observations apply to the corrosion of other metals. The cathode should be of such material that it is not corroded by the cathode solutions. The electrolyte is the all important factor. The two products must be kept separate in the cell, by using proper diaphragms, and the best arrangement is the use of double diaphragms, with the pure electrolyte fed into the space between and the solution standing at a higher level inside. This gives a pressure producing a flow into both compartments, and overcomes any tendency of the cathode or anode solutions to pass backwards through the partitions. A light, firm canvas gives very satisfactory results as a diaphragm. Devices for automatically preserving the difference of level are illustrated and described. About 1.4 volts will give a current density of 10 amperes per square foot, and the apparatus as finally arranged worked perfectly. Tests were made with it on the many processes proposed for manufacturing white lead, with interesting results. The conclusion is that it is entirely possible to produce a white lead of exactly the same composition, as far as the relative amounts of hydroxide and carbonate of lead are concerned, as in the old Dutch process, and that the physical properties can also be duplicated, but there is very little chance of the commercial success of such a process because of its cost. A bibliography (not as complete as it might be) is appended.

J. W. RICHARDS.

The Formation of Nitric Acid by Electric Energy. BY C. W. VOLNEY. *Trans. Am. Electrochemical Soc.*, Vol. III (1903).—This gives a record of experiments carried on in a reaction flask of 1 liter capacity, with electrodes 15 mm. apart, the current coming from a transformer giving 8 amperes at 8 volts. This produced in air the yellow vapors in 45 seconds, and nitric oxide gas inside of a minute. The result of acting on nitric oxide gas showed a maximum of 3.58 per cent. converted into peroxide and nitrogen in twenty minutes. The author concludes from his experiments that the formation of trioxide and pentoxide electrically is out of the question, as they decompose at all temperatures over 15°. The tetroxide is the highest oxidation product which can be formed electrically, and the yield is small, both absolutely and compared with the energy employed. J. W. RICHARDS.

Electrolytic Experiments with Metallic Diaphragms. BY W. D. BANCROFT. *Trans. Am. Electrochemical Soc.*, Vol. III (1903).—When the diaphragm does not completely fill the cross-

section of the cell, the percentage of the current passing through the diaphragm depends on the surface, thickness, and nature of the diaphragm, on the nature of the electrolyte, and on the fall of potential in the electrolyte. The current will always pass through an interposed plate unless prevented by polarization. Copper is deposited upon the negative side of a platinum partition even when the drop of potential in the electrolyte from one side of the partition to the other is less than that theoretically required to deposit copper from a normal copper sulphate solution. The author does not see why this should be so. The explanation is that the energy absorbed is that theoretically necessary, but part of the copper deposited is redissolved, giving back energy, and so only a fraction of the critical voltage is necessary to supply all the energy required. J. W. RICHARDS.

AGRICULTURAL CHEMISTRY.

Influence of the Soil on the Protein Content of Crops. BY A. R. WHITSON, F. J. WELLS, AND A. VIVIAN. *Wis. Agr. Expt. Sta. Rep.*, 1902, pp. 192–209.—In a study of this question, plant-house and field experiments were conducted with corn, oats, barley, rape, and cow-peas. The crops were grown on soils of different degrees of fertility and determinations were made at frequent intervals of the available nitrogen in the soils and the protein in the crops. In one test, the proteid nitrogen, in oats grown on soils having the same physical composition but different degrees of richness in nitrates, was 1.93 per cent. on the poorest soil, 2.53 per cent. on the medium fertile soil, and 2.66 per cent. on the richest soil. In a similar test with corn the figures were, respectively, 1.35, 1.59, and 1.80 per cent. The results of the experiments as a whole indicate that farm crops vary greatly in their protein content at the same stage of development, and that this variation may exist even when the crops are making practically equal growth. Under similar seasonal conditions, the amount of nitrates in the soil is believed to be the most important factor in causing this variation. H. W. LAWSON.

Field Experiments with Fertilizers. BY C. S. PHELPS. *Conn. Storrs Agr. Expt. Sta. Rep.*, 1901, pp. 122–147.—One object of these experiments, which are continued from year to year, was to study the effect of nitrogenous fertilizers upon the amount of protein in the crops grown. In the case of corn, the percentages of nitrogen and protein in both grain and stover were highest where the largest quantity of nitrogen had been used in the fertilizer. In the leguminous plants (cow-peas and soy-beans) the protein was increased but little, if any, by the use of nitrogenous fertilizers. H. W. LAWSON.

Pot Experiments with Nitrogenous Fertilizers. BY C. S. PHELPS. *Conn. Storrs Agr. Expt. Sta. Rep.*, 1901, pp. 154–164.

—The object of these experiments was the same as that noted in the field experiments above. The results for three years indicate that the percentages of nitrogen and protein in some of the common grasses and in millet were greatly increased by the nitrogen applied in the fertilizers. While the experiment with oats was not as satisfactory, similar results were obtained. On the other hand, the protein in soy-beans was not increased by the use of fertilizers rich in nitrogen. H. W. LAWSON.

A Rotation Study. BY F. S. SHIVER. *S. C. Agr. Expt. Sta. Bull. No. 79*, 62 pp.—Two series of twelve tenth-acre plats each were used in this study. In one series, commercial fertilizers were applied and cow-peas when grown were removed. In the other series no fertilizers were applied, but cow-peas were frequently grown and plowed under. Various rotations were compared. The soil and subsoil of each series were analyzed at the beginning of the study and again at the close, three years later. Available phosphoric acid was determined by digestion with ammonium citrate solution and with one-fifth normal hydrochloric acid. Available potash was determined by digestion with one-fifth normal calcium chloride solution and with alkaline ammonium chloride. Each crop grown was analyzed. The available phosphoric acid was invariably higher by the ammonium citrate method, attributed to this solvent dissolving some of the phosphoric acid in combination with humus. As regards the availability of phosphoric acid in the soil, the results with the ammonium citrate method agreed approximately with crop records in 50 per cent. of the cases and the results with hydrochloric acid agreed in 66 per cent. The results with the two methods for determining available potash agreed closely and corresponded to crop data in 63 per cent. of the cases. The author believes that none of these methods, in their present shape, give absolutely reliable results for available phosphoric acid and potash. Cotton grown continuously on some of the plats greatly reduced the percentage of humus. No better results as regards the maintenance of humus in the soils were obtained by plowing under cow-peas than by the removal of this crop combined with the use of cottonseed meal, acid phosphate, and kainit as fertilizers. Wheat was grown on all the plats the fourth year, the yields in 13 out of 24 cases agreeing closely with the gains and losses of nitrogen, humus, and humic nitrogen in the plats as previously observed.

H. W. LAWSON.

Nitrification in Different Soils. BY W. A. WITHERS AND G. S. FRAPS. *N. C. Agr. Expt. Sta. Rep.*, 1902, pp. 31–41.—The rate of nitrification of ammonium sulphate and cottonseed meal in 8 soils from 4 different states was studied. Calcium carbonate was found to exert a decided accelerating influence upon the nitrification of both substances, especially the ammonium sul-

phate. Ammonium sulphate was nitrified to a greater extent than cottonseed meal in some soils, while in other soils the reverse was true. Some of the soils showed very little nitrifying power. Brief notes are given on the nitrifying organisms.

H. W. LAWSON.

The Determination of Sulphur and Chlorine in Plants. BY G. S. FRAPS. *N. C. Agr. Expt. Sta. Rep.*, 1902, pp. 44–49.—This work was presented in greater detail before the Association of Official Agricultural Chemists, in 1902. The results as summarized favor the nitric acid method, modified by the substitution of calcium acetate for potassium nitrate, for the determination of total sulphur, and the method of ignition with sodium carbonate for the determination of chlorine. The loss of chlorine which takes place on ignition is considered as due probably to the decomposition of chlorides and not to their volatilization.

H. W. LAWSON.

The Sulphur Content of Some Vegetable Materials. BY W. A. WITHERS AND G. S. FRAPS. *N. C. Agr. Expt. Sta. Rep.*, 1902, pp. 53–58.—The authors determined the sulphur in a number of vegetable materials, using the nitric acid method modified by the use of calcium acetate in place of one-half of the potassium nitrate. Some of the average results are as follows: Cottonseed meal 1.10 per cent. (sulphur as SO_3), cottonseed hulls 0.176 per cent., oats 0.491 per cent., cow-peas 0.466 per cent., corn 0.338 per cent., and peanuts 0.471 per cent. The ash contained from $^1/_{50}$ to $^4/_5$ of the total amount of sulphur found in these plants. The conclusion is drawn, therefore, that the sulphur content of an ash is no indication as to the amount of sulphur in the plant. The sulphur content was greater in some cases than that of potash, soda, lime, or magnesia, making it seem probable to the authors that sulphur plays a more important part in plant nutrition than has been suspected.

H. W. LAWSON.

Ash Analyses of Some New Mexico Plants. BY A. GOSS. *New Mex. Agr. Expt. Sta. Bull. No. 44*, 14 pp.—The author reports in tabular form ash analyses of salt grass, bunch grass, sea blite, cachanilla, shadscale, creosote bush, popotillo, century plant, sotol, soapweed, Spanish dagger, ocotillo, prickly pear, tree cactus, chico bush, and alfalfa, and describes the different plants. In general, the percentage of ash was high as compared with that of plants in nonarid regions. The percentage in the water-free material varied from 3.44 in the case of cachanilla to 24.18 in one species of prickly pear. Not only the total ash, but the different constituents varied greatly with the different species of plants. There was no uniformity in the ash constituents of plants grown on alkali soils. The kind of plant has apparently as much to do with its mineral composition as has the environment under which it grew. The value of the nitrogen, potash, and phosphoric acid

removed from the soil by alfalfa was estimated at current eastern prices to exceed $11 per ton of dried material. The author made a comparative study of the sulphur in the ash, as determined by the method of the Association of Official Agricultural Chemists, and the sulphur in the unburned plant material, as determined by fusion with potash and potassium nitrate. Averaging all results, the sulphur in the ash was 0.29 per cent., and the sulphur in the plant 0.71 per cent. The percentage of sulphur lost in burning varied from 34 to 94 per cent., with different plants. The conclusion is therefore drawn that the determination of sulphur in the ash with a view to determining the amount originally present in the plant is absolutely worthless. In determining sulphur in the plant material, the author finally resorted to the use of large iron crucibles instead of platinum as previously given in this method. H. W. LAWSON.

On the Digestibility and Availability of Food Materials. BY W. O. ATWATER. *Conn. Storrs Agr. Expt. Sta. Rep.*, 1901, pp. 179–245.—Fifty digestion experiments made with three men are reported. The diet was simple, containing a number of common animal and vegetable food materials. The digestibility of the nutrients was apparently unaffected by the amount of muscular exercise taken. The results of these and other experiments, while not warranting final conclusions, indicate that the coëfficients of availability (commonly called digestibility) of the nutrients of a mixed diet, when eaten by people in good health, are not far from 92 per cent. for protein, 95 per cent. for fat, and 97 per cent. for carbohydrates. The proportions of animal and vegetable foods modify these factors, however, to a considerable extent. Roughly speaking, about 95 to 96 per cent. of the total organic matter in a mixed diet and 91 to 92 per cent. of the total energy will be available. H. W. LAWSON.

Dietary Studies in American Cities. Edited by R. D. MILNER. *U. S. Dept. of Agr., Office of Expt. Stas. Bull. No.* 129, 103 pp.—In all, sixty dietary studies are published in full. In those made in Boston and Springfield, Mass., by Lydia Southard, Susannah Usher, and Bertha M. Terrill, a practical application was made of results already obtained in nutrition investigations. Satisfactory diets corresponding to accepted standards and at costs decided upon beforehand were supplied, with results regarded in the main as successful. In one series, dietaries of low, medium, and high cost were studied with the same group of persons. In the dietary studies of families of different nationality in Philadelphia and Chicago, made by Ellen H. Richards and Amelia Shapleigh, the net results are considered of undoubted value to the settlement associations under whose auspices they were made, by furnishing more accurate information than could

otherwise have been obtained regarding the ways of living, the adequacy of the diets and the faults in methods of purchasing, cooking, and serving food. H. W. LAWSON.

Dietary Studies of Groups, Especially in Public Institutions. BY C. F. LANGWORTHY. *U. S. Dept. Agr., Office of Expt. Stas. Rep.*, 1902, pp. 387–416.—The author reviews the experimental work, done in this country and abroad, relating to the feeding of large numbers under uniform conditions, as in armies, schools, hospitals, and other institutions, and discusses the general problems involved. H. W. LAWSON.

The Composition of Frozen Milk. BY E. H. FARRINGTON. *Wis. Agr. Expt. Sta. Rep.*, 1902, pp. 136–137.—When about $^1/_4$ of the sample was frozen, the fat content of the liquid portion was increased about 0.5 per cent. When about $^1/_2$ of the sample was frozen the liquid and frozen portions had practically the same fat content. The other constituents were still less, if at all, affected by freezing. H. W. LAWSON.

The Water Content of Creamery Butter. BY H. E. ALVORD. *U. S. Dept. Agr., Bureau of Animal Industry Circ. No. 39*, 4 pp.—The percentage of water was determined in 802 samples of creamery butter made from May to September, 1902, in 400 creameries located in 18 states. The water content ranged from 7.2 to 17.6 per cent. and averaged 11.78 per cent. Nearly seven-eighths of the samples were between 10 and 14 per cent. Only 8 were above 16 per cent., the legal maximum standard in Great Britain and Germany. H. W. LAWSON.

Observations on the Use of Acid Tests for Milk and Cream. BY E. H. FARRINGTON. *Wis. Agr. Expt. Sta. Rep.*, 1902, pp. 128–135.—Standard alkaline solutions were found to be unaffected by freezing and thawing. The loss in strength of standard solutions kept for different lengths of time was determined in a series of tests. The necessity of mixing samples of sour milk or cream to be tested for acidity was shown in an experiment in which the curd and the whey in the same sample neutralized different amounts of alkali. This is accounted for by the fact that casein acts as an acid toward alkaline solutions. The acidity of cream was shown to be modified by the fat content. While the acid developed in skim milk reached 0.78 per cent., the acid developed in cream containing 50 per cent. of fat did not test above 0.11 per cent. H. W. LAWSON.

The Influence of Soil and Climate Upon the Composition of the Sugar-Beet, 1901. BY H. W. WILEY. *U. S. Dept. Agr., Bureau of Chem. Bull. No. 74*, 42 pp.—This bulletin gives the results of the second year's study of the influence of environment

upon the composition of the sugar-beet, the work being done in collaboration with the Weather Bureau and the experiment stations in Indiana, Iowa, Kentucky, Michigan, New York, Utah, Virginia, and Wisconsin. The experiments are reported in full and descriptions and analyses are given of a number of the soils upon which the experiments were made. The conclusion is drawn that the chemical and physical properties of the soil exert but little influence upon the sugar content of the beet. In the author's experience, beets grown in a swamp soil, rich in vegetable mold, were found to have almost the same content of sugar as beets grown in a soil almost pure sand. As regards the influence of climate, the results on the whole show that the sugar content increased with the latitude and with the length of the day, but that it was not materially influenced by the percentage of sunshine. The sugar diminished as the temperature increased. In one case, altitude showed a marked tendency to increase the sugar content, but in another case this was not apparent. The composition of the sugar-beet is influenced more by the distribution of rainfall during the season than by the actual amount, so long as there is a sufficient quantity to secure normal growth.

H. W. LAWSON.

Sugar-Beet Experiments, 1902. BY C. D. SMITH. *Mich. Agr. Expt. Sta. Bull. No. 207*, pp. 63–75.—Analytical data covering a period of six years show, in general, an increase in the sugar content of beets in passing from the southern to the northern portions of the state. The average sugar content of beets grown in the lower tier of counties was 13.6 per cent., and in the Upper Peninsula 15.4 per cent. The experiments in the Upper Peninsula, a more detailed account of which is given in Special Bulletin 18 of the station, have been in progress, however, only one year and definite conclusions are not considered warranted. The results of a culture experiment continued for four years show a much greater exhaustion of the soil by sugar-beets than by brome-grass, flat pea, millet or clover. H. W. LAWSON.

The California Sugar Industry. BY G. W. SHAW. *Cal. Agr. Expt. Sta. Bull. No. 149*, 54 pp.—The history of the beet sugar industry in the state is reviewed and considerable statistical matter relating to the present status of the industry is given. California claims credit for being the first state in the Union to manufacture beet sugar on a commercial scale. At present there are eight factories in the state. The total production of sugar in 1901 was 143,947,800 pounds. H. W. LAWSON.

Sugar-Cane Culture in the Southeast for the Manufacture of Table Syrups. BY H. W. WILEY. *U. S. Dept. Agr., Bureau of Chem. Bull. No. 75*, 40 pp.—The first part of the bulletin reports fertilizer experiments conducted in Georgia by W. B. Rod-

denbery, from which numerous practical conclusions are drawn. The second part contains reports of special agents on sugar-cane culture in seven localities in Georgia, Alabama, Mississippi and Florida. Analyses of over 150 samples of cane juices are included, the average of which shows 12.03 per cent. of sucrose, 1.82 per cent. of reducing sugar, and a purity of 75.99. The effort was made to obtain the average composition of canes as they were delivered to factories for commercial purposes, rather than the composition of selected canes. The composition was fairly constant in the different localities from which samples were obtained. Such canes are not considered suitable for the manufacture of sugar on a commercial scale. They are, however, excellent for syrup making. "The high quantity of reducing sugar, which interferes with sugar manufacture, is no bar to syrup manufacture; on the contrary, it is an advantage, as the reducing sugar is quite as sweet and palatable as sucrose and has a much lower coefficient of crystallization. Hence its presence in the product, while impairing neither its appearance nor its taste, improves the selling qualites of the syrup by diminishing the tendency to crystallization." H. W. LAWSON.

Notes on Vinegar Making. BY E. F. PERNOT. *Oreg. Agr. Expt. Sta. Bull. No. 73*, 8 pp.—This gives an account of the successful manufacture of vinegar from overripe, undersized, and otherwise unsalable prunes. The vinegar produced from the waste prunes was of excellent quality, but was rather dark in color. The acetic acid, in one case, was as high as 8.59 per cent. The total content of solids was 6.87 per cent. H. W. LAWSON.

The Value of Oak Leaves for Forage. BY W. W. MACKIE. *Cal. Agr. Expt. Sta. Bull. No. 150*, 21 pp.—In studying the forage conditions in a forest reserve in the northern Coast Ranges in 1902, the author observed that a large part of the nourishment of stock was obtained by browsing on the various oaks. In this bulletin he has given illustrated descriptions of the seven species under investigation; field notes concerning the extent to which the different species were browsed by horses, cattle, sheep, and goats; and analyses of the leaves. The water content of air-dry samples of the leaves of the different species varied from 3.54 to 6.53 per cent., ash 8.66 to 9.66, protein 6.85 to 15.05, crude fiber 16.26 to 33.35, tannin 5.0 to 14.06, nitrogen-free extract 30.89 to 41.05, and ether extract from 3.50 to 6.50 per cent. The leaves of the deciduous oaks were more nutritious than those of the live oaks and were more readily eaten by stock. The forage value of the leaves apparently increased with the altitude.

H. W. LAWSON.

The Determination of Pentosan-Free Crude Fiber. BY G. S. FRAPS. *N. C. Agr. Expt. Sta. Rep.*, 1902, pp. 59–62.—This

paper was presented before the Association of Official Agricultural Chemists in 1901. The results of tests were in favor of the König method, which was found to yield a fiber practically free from pentosans and to require fewer manipulations and less time than the usual method. H. W. LAWSON.

Insecticide Studies. BY J. K. HAYWOOD. *U. S. Dept. Agr., Bureau of Chem. Bull. No. 76*, 63 pp.—In earlier investigations, the author observed the presence of lead chromate in a number of pyrethrum powders, known also as Buhach, Persian or Dalmatian Insect Powder, etc. To determine the extent of such use in the United States, samples were collected through the experiment stations and examined for coloring matter. Of 105 samples examined, nineteen were found to be colored with lead chromate. Cases of poisoning by chromates are quoted from the medical journals. As pyrethrum powders are always advertised to be harmless to human beings and as they are often used in dwellings where the inhalation of the dust is unavoidable, the addition of lead chromate for the purpose of imparting a bright yellow color is naturally considered by the author very reprehensible practice. Part 2 of this bulletin contains 308 analyses of insecticides and fungicides made by the experiment stations in the various states, together with twelve analyses made by the Bureau since the publication of Bulletin 68, which contains a large number of such analyses. Part 3 consists of a compilation of state laws governing the composition and sale of insecticides. H. W. LAWSON.

The Influence of Formaldehyde on the Germination of Oats. F. CRANEFIELD. *Wis. Agr. Expt. Sta. Rep.*, 1902, pp. 268–272.—Seed oats treated with a solution composed of $2^1/_2$ parts of formaldehyde in 1000 parts of water were injured to the extent of 6.4 to 17.4 per cent. With stronger solutions the injury increased proportionately. Notwithstanding these results, the author believes in the continued use of this method for the prevention of smut. H. W. LAWSON.

PATENTS.

FEBRUARY 3, 1903.

719,623. Herman H. Spohn, Boston, Mass. Assignor to Carter Ink Co., same place. **Ink.** Soluble Prussian blue 20, aniline dye 10, tannin 4, and carbolic acid 4, water 1240 parts.

719,660-1. Henry Halsey, New York, N. Y. Assignor to Halsey Electric Generator Co., Jersey City, N. J. **Electric battery.** Rotating concentrically arranged electrodes with brushes between them to clear the precipitates and thereby maintain the output of the battery.

719,698. Heirich F. D. Schwann, St. Louis, Mo. **Producing**

aluminum. An aluminum compound is exposed at a reducing temperature to the action of an upward current of a mixture of hydrocarbon gases containing sulphur.

719,720. Max Baslen, Ludwigshafen-on-Rhine, Germany. Assignor to Badische Anilin und Soda Fabrik, same place. **Hydrosulphite for reducing indigo.** A mixture of sodium bisulphite and sulphurous acid which has the formula $Na_2S_2O_4 + H_2O$, 100 cc. of which at 17° Beaumé contains 9 grams of the salt.

719,752. Miller E. Conrad, Atlantic, Iowa. **Voltaic cell.** A positive and negative electrode, an electrolyte, and means for depolarizing, being a metallic oxysulphide in contact with the negative electrode so as to combine with the polarizing hydrogen and form hydrogen sulphide.

719,756. Stanley C. C. Currie. Assignor one-half to William Courtenay, all of New York, N. Y. Apparatus for mixing and storing liquids and gases in **ore treatment.** In combination, a water-tank and a caustic alkali tank at a lower level and a stock tank at a still lower level, all connected by pipes and a by-pipe connecting the end tanks of the series, and a mixing tank with inclined shelves below the stock tank and having a chlorine supply, a storage tank for chlorinated liquid and an absorption vessel at the end of the series, all on a down grade.

719,757. Same as above. Obtaining **precious metals.** Heats powdered ore and drops it in an alkaline solution, generating steam which is used to treat more ore, and then washing out of the ore the soluble portions.

719,787. Louis G. Naert, Audenarde, Belgium. **Artificial leather.** A woolly or felted surface is formed upon the goods serving as base, this is impregnated with cellulose xanthate (viscose) which is fixed and then coated with rubber or gutta percha solution.

719,830. Edward S. Meade, Philadelphia, Pa. Assignor to North American Fuel Co., Camden, N. J. **Briquettes.** Lignite is heated to expel moisture, powdered and mixed with molasses, then heated to coke the molasses.

719,833. Joseph B. Miller, Sedalia, Mo. **Fire-extinguishing compound.** Sodium bicarbonate 30, soda ash and slaked lime 5 each, manganese $1^1/_4$, meal powder and sulphur $^5/_8$ each, saltpeter $^1/_2$, oxalic acid 1, sea sand 8, pulverized soapstone 1 pound, sulphuric acid, hydrochloric acid and ammonia 1 ounce each.

719,844. Wm. A. McKee, Hinckley, N. Y. **Acid chamber for sulphite works.** A supply tank for alkaline liquid is provided with an agitator and pipe connecting with a smaller charging cylinder having a rotary agitator with coned deflectors above conical hoppers and means for drawing an acid gas through both vessels.

719,882. Joseph Scales, Niagara Falls, N. Y. Assignor to Union Carbide Co. of Va. **Subdividing block of carbide.** Drills a hole in the blocks and injects water or steam into the hole through the drill.

719,953. Charles M. Oliver, Baltimore, Md. Assignor one-third to Maurice Joyce, Washington, D. C. **Oxidizing matrices.** An oscillating trough and a sifter over said trough, whereby the liquid flows across the matrix and a metallic powder is sifted on it.

719,973. James A. Wotten, Atlanta, Ga. **Electric condensers.** Immersing plain paper, forming the dielectric of a condenser after arrangement, in a bath of paraffine raised to about 130° C. for an hour to drive off moisture.

720,088. Alexander Waddell, Pittsburg, Pa. Making **briquettes.** Mixes fine coal with lime, partially cokes it, compresses it into blocks and coats with a resinous substance.

720,122. Josiah B. Espey, Springfield, Ohio. **Cereal food.** Treats grain to a bath containing formaldehyde, with agitation, rubs the grain and floats off the hulls, washes and cooks the whole grain, which is then dried and ground.

720,142. Friedrich Heuber, Charlottenburg, Germany. **Artificial lithographic stone.** Pulverized limestone and burnt magnesite are mixed with magnesium chloride to a thin paste which is then molded and pressed.

720,157. George Klenk, Hamburg, Germany. **Decolorized tannin extract.** A solution of aluminum sulphate is added to hot, crude tannin extract, then sodium sulphite is added with continuous stirring, then cooled to between 20° and 25° C., then drawing off and allowing to settle.

720,235. Hans A. Frasch, Hamilton, Canada. Obtaining **metals by electrolysis.** A series of vats are arranged in steps and the liquid returned from the last and lowest to the top of the series. Copper, nickel, cobalt, etc., are separated from their ores by forming anodes of the ore, electrolyzing an alkaline salt whose negative radical combines with the metal, and the liquid being circulated throughout the series, electro-depositing the copper and reusing the electrolyte.

720,267. Joseph Loudenslager, Tiffin, Ohio. **Boiler compound.** Catechu, potash, soda ash, and German salts. (Spindel salz) $CaSO_4$ 0.02, $NaHCO_3$ 0.36, NaCl 0.18, Na_2SO_3 0.44 per cent.

720,300. Piter Vervaet, Paterson, N. J. **Welding compound.** Molten glass and molten borax are mixed and cooled till it hardens and the mass is then pulverized.

720,326. Rufus N. Chamberlain, New York, N. Y. Assignor to Gould Storage Battery Co., same place. Preparing

storage battery plates. Lead plates are cleaned and made anodes in an electrolyte capable of dissolving lead as nitric acid, thereby roughening the plates and producing a solution of lead which is redeposited on a cathode, and removing and forming the plates.

720,348. William Holzer, New York, N. Y. Assignor to Alice Holzer, same place. **Compressing fluid metals.** Puts mercury in a suitable vessel, immerses the metal or other material in said mercury, closing the vessel so that the contents exactly fill it and heating mercury to obtain pressure by the expansion of the mercury.

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720,361. Constantin Krauss and Rudolph von Berneck, Hochst-on-Main, Germany. Assignors to Farbwerke, vormals Meister Lucius und Bruning, same place. **Regenerating contact substances.** Platinum contact substances used in making sulphuric anhydride receive a mixture of steam, purified pyrites burner gases, and oxygen, till arsenic disappears, then dried, purified burner gases and oxygen are introduced till the substance regains its normal activity.

720,402. Julius Bueb, Dessau, Germany. Producing **cyanogen compounds.** Heats pieces of refractory material to a converting temperature, by contact of oxidizing flames or fire gases, and exposing said material to the cyanogen yielding gases whereby it becomes covered with a carbonaceous deposit, then again heating the material with an oxidizing flame till the deposit is burned away and repeating these operations, the carbonaceous deposit being obtained from specified residues of beet-sugar, etc., carbonized in closed vessels.

720,490. Marcus Ruthenburg, Philadelphia, Pa. **Reducing ores.** The process of reducing ores containing volatile and non-volatile metals by maintaining a molten pool beneath a highly heated atmosphere, mixing the pulverized ore with a fluid hydrocarbon, spraying the mixture with compressed air into the hot atmosphere thereby burning the hydrocarbon and reducing the ore over the pool which receives the non-volatile products including the reduced metal, and progressively withdrawing from the pool the molten magma with the reduced metal.

FEBRUARY 17, 1903.

720,500. Henry W. Morrow, Wilmington, Del. **Fuel compound.** Carbon, clay mixed with light earth, and acidified saccharine matter.

720,670. Andrew C. J. Charlier, Glasgow, Scotland. **Lead pigment.** Carbon dioxide is passed through litharge suspended in water at a pressure of two hundred pounds.

720,739. William G. Roach and Albert C. Roach, Cincinnati,

Ohio. Assignors three-fifths to Yeiser and Wernicke, same place. **Artificial stone.** Clay 12, sand-lime 9 parts, and fluor spar about 10 per cent. are fused, cast and slowly annealed.

720,765. Allen Webster, Springfield, Mass. **Pen-cleaning compound.** Clay, glycerin, and emery worked into a stiff mass.

720,779. Thomas H. Brown and John E. Staples, Wellington, New Zealand. **Branding fluid.** For carcases, poultry, etc. Silver nitrate 12, logwood and water 3 each, methylated spirit 18 parts.

720,799. Hiram M. Hanmore, Los Angeles, Cal. **Wall plaster.** Diatomaceous earth 50, calcic oxide 30, kaolin and fiber 10 parts each.

720,848. Erich Schwanenberg, Hanover, Germany. **Artificial stones.** Pulverized burnt lime and slaked lime are mixed with water, and treated alternately with CO_2 and air till fully impregnated.

720,850. George R. Sherwood, Chicago, Ill. **Cellulose from cornstalks.** Removes the cuticle of the stalk from the pith and boils the latter in caustic soda solution under pressure, by which the pith is disintegrated, and the flibro-vascular elements separated.

720,877. Emil Bloch, Cincinnati, Ohio. **Transparent mirror.** A thin coating of Rochelle salts 2, and stannic chloride 1 part, is applied to the back of a mirror in liquid form while warm, then coated with shellac.

720,920. Carl Hoffman, Hochst-on-Main, Germany. Assignor to Meister, Lucius und Bruning, same place. **Alkylated auramins.** Heats tetralkyl-*p*-diaminobenzophenonimide with one equivalent of an alkyl haloid and five parts calcined magnesia, then heats to 130° C.

720,922. George S. Holder, Lowell, Mass. **Wool lubricant.** Turpentine pitch and quillaia are dissolved in water, soda ash and ammonium carbonate are added and the mixture again boiled, then borax and then hot lard, cottonseed oil, oleïc acid and caustic soda, boiling after each addition, and finally palm oil, cottonseed oil, lard oil, olive oil, and water.

720,927. Charles B. Jacobs, East Orange, N. J. Assignor to United Barium Co., Jersey City, N. J. **Barium hydroxide.** Barium oxide and sulphide are heated with water, filtered, rapidly crystallized in small crystals, washed, dried, fused and treated with superheated steam and zinc sulphate.

721,054. Erick W. Lindquist, Weymouth, Mass. Assignor to Irving L. Drake, Providence, R. I. **Polishing compound.** Paraffin oil 8, and water 2 gallons, and 2 ounces of antimony trichloride.

721,068. Wm. F. M. McCarty, Rocky Ridge, Md. Appara-

tus for **electrolysis of water.** Two tanks immersed in a water jacket and communicating by a central pipe, having electrodes with wires leading in through the bottoms of the tanks which have outlets at their upper ends for gas and a water supply opening above the normal water level into one of the tanks.

721,091. George F. Rendall, New York, N. Y. Making **carbonates and chlorides.** Lead ore is roasted to a sponge, any iron is removed, acetic acid is added and warmed till a basic solution is formed, treating an alkaline carbonate with dilute hydrochloric acid till it is converted into a chloride and the CO_2 given off is sent into the lead solution, making white lead.

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721,150. Oliver P. Catherman, Mifflingburg, Pa. **Compound for removing paint** etc. Cow dung 3, horse and chicken manure each 2, human feces and concentrated lye each 1, quicklime $^1/_2$ and rye flour paste $^1/_4$ pound, and water one quart.

721,171. Frank Flor and Ernst Murmaan, Vienna, Austria-Hungary. **Wrapping paper for metal articles.** Paper impregnated with ammoniated copper hydroxide to prevent tarnishing.

721,282. Hugo Buderous, Hirzenhain, Germany. Treating **molten iron.** Molten slag is put in a mixing chamber, fuel placed on top, and then molten iron from the blast furnace with which the matter used to improve the iron is continuously mixed while a continuous supply of fuel and iron is kept up, and the finished iron run into molds.

721,290 Mary L. Fisher, Kansas City, Mo. **Washing blue.** Acid pink, gum Senegal, gum Arabic, fustic extract and Tiemann's soluble blue.

721,311. Emil Knudsen, Sulitjelma, Norway. **Smelting process.** Sulphide ores are charged in a furnace whose lining is already highly heated sufficiently to fuse the ore, through which a cold blast is driven to burn the sulphur which liberates enough heat to smelt the charge and this charge is removed and another added before the furnace cools.

721,314. John M. Lyman, Chicago, Ill. **Lump starch.** Pulverized starch 80 per cent. and water 20 per cent. is centrifugated through a fine mesh to make it fine and soft, then heated to 200° F., and strongly pressed in hot cylinders till adhesion takes place, then broken into lumps and subjected to 90° F. for forty-eight hours.

721,383. Arvid Nilson, Chicago, Ill. Assignor to Wahl and Hennis, same place. **Non-intoxicating beverage.** Grain is mashed, the wort drawn off, rapidly cooled and fermented, then boiled to expel the alcohol, hops added, cooled and carbonated.

721,467. Auguste J. Rossi, New York, N. Y. Assignor one-

half to James McNaughton, Tahawus, N. Y. **Alloy.** Iron, carbon, and from 2 to 5 per cent. of titanium, the alloy being fusible at the melting-point of iron.

721,489. William Wolters, Magdeburg, Germany. **Citrate-soluble phosphates.** Phosphorite 100, chalk 80, and silicates 84 parts are mixed and heated to a thin fluid mass at about 1200° C.

721,553. Samuel K. Felton, Jr., Philadelphia, Pa. Treating **hides.** A compound of lime and arsenic is applied to the flesh side of the skin, the hair is removed, and first sodium sulphide and then sodium hyposulphite applied and the skin afterwards finished in lime and arsenic baths.

721,633. James B. Eaton, Center Point, Texas. **Medicated salt brick for stock.** One-half assigned to George Bass Blackman, Chattanooga, Tenn. Salt 65, clay 30, sulphur 2, saltpeter and copperas 1 pound each, powdered nux vomica 6, and santonin 2 ounces.

721,638. Eugen Straus, Nuremburg, Germany. **Refining metals,** etc. The vapors of the metal, metalloid, or alloy are passed through a fused zone of an oxygen combination of said metal or metalloid, etc.; and collected in a mold formed in the non-fused portion of the said material.

WILLIAM H. SEAMAN.

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WILLIAM A. NOYES, Editor.

GENERAL AND PHYSICAL CHEMISTRY.

The Ultra-Violet Reflecting Power of Selenium, Cyanine and Glass. BY P. G. NUTTING. *Phys. Rev.*, **16**, 129–139.—The author uses a photographic photometer, based on that of Wild, which should be capable of great delicacy. Two beams of ultra-violet light of variable and known intensity are made to produce overlapping interference bands on the same photographic plate, thus producing a series of parallel stripes which, however, disappear when the two beams are of equal intensity. In the path of one beam a standard mirror is placed, in the other, the surface to be investigated. The author's results for the reflecting power of selenium do not agree with those calculated by means of Drude's reflection formula from the reflective and absorptive indices obtained by Wood. In the case of cyanine, the curve obtained agrees in form with the calculated, but the optical properties of the surface change rapidly on exposure to light. Data for several kinds of glass and for steel are also given.

G. N. LEWIS.

Note on Selective Absorption of Fuchsine and Cyanine. BY WILLIAM WEBER COBLENTZ. *Phys. Rev.*, **16**, 119–122.—Thin films of fuchsine and cyanine were allowed to solidify on the faces of rock salt crystals. Both substances begin to transmit light of wave length, 0.6—0.7μ, and have maxima of absorption at 3.5μ, 6.5μ and 8.2μ. The absorption becomes constant beyond 9μ for fuchsine, beyond 11μ for cyanine. The very remarkable similarity between the two curves leads the author to conclude that cyanine must be closely related to fuchsine in chemical constitution.

G. N. LEWIS.

The Infra-Red Emission Spectrum of the Mercury Arc. BY W. W. COBLENTZ AND W. C. GEER. *Phys. Rev.*, **16**, 279–

286.—By combining spectrometer and radiometer, the authors measured the energy of the whole spectrum of the mercury arc. Two strong series of emission bands were found at wave-lengths 1μ and 5μ, and possibly a weaker one at 3μ. The existence of the strong emission in the infra-red shows that the lighting efficiency of the arc is less than has been supposed. The measured emission bands corroborate, to some extent, the theoretical predictions of Kayser and Runge. G. N. LEWIS.

The Change of Volume in Clark and Cadmium Cells and Its Relation to Change of Electromotive Force Due to Pressure. BY ROLLA R. RAMSEY. *Phys. Rev.*, 16, 105–111.—The author measures the change in volume in the Clark and cadmium cells during the passage of a certain quantity of electricity. From this change he calculates, thermodynamically, the effect of pressure on the electromotive force and compares this with the effect of pressure found by experiment. Owing, doubtless, to errors in the experimental data, the two values agree only in sign and order of magnitude. G. N. LEWIS.

On the Relation of the Dielectric Constant of Water to Temperature and Frequency. BY A. DE FOREST PALMER, JR. *Phys. Rev.*, 16, 267–278.—By means of the sensitive differential method previously described in this review (24, 276), the author determines the temperature coëfficient of the dielectric constant of water with alternating currents of different frequencies. For each frequency the results are remarkably self-consistent, and show that the temperature coëfficient is very nearly a constant between 0° and 16°, but that it varies with different frequencies, being more than half again as great at three million cycles per second as at sixty per second. The author scrutinizes his method and fails to find any evidence of a constant error to which the apparent influence of frequency upon the dielectric constant may be attributed. He hesitates to conclude, however, that the results may not be so explained, especially as a compilation of the results of ten observers shows that the wide variations in former determinations bear no relation to the current frequency.

G. N. LEWIS.

Some Experiments on the Electrical Conductivity of Atmospheric Air. BY J. C. MCLENNAN AND E. F. BURTON. *Phys. Rev.*, 16, 184–192.—A number of investigators have observed the continual ionization of both common atmospheric air and air in enclosures. With the object of studying this phenomenon, the authors have measured the conductivity, from time to time, of air enclosed in cylinders, lined with different metals. In every case, the cylinder was filled with pure air and sealed. The conductivity always fell off rapidly, reaching a minimum in a few hours and then rose gradually to a constant value, which varied accord-

ing to the metal lining used, diminishing in the order, lead, tin, zinc. This phenomenon is explained plausibly on the theory that the atmospheric air originally possesses radioactive emanation subject to rapid decay, while the metal walls emit another emanation which gradually fills the enclosure until its rate of production equals its rate of decay. The authors show, however, that a part of the final conductivity is due to an external source, for immersing the cylinder in water lowers the conductivity considerably. They concluded, therefore, that their room must be constantly traversed by rays capable of penetrating through metal walls. When all other conditions were constant, the final conductivity was found to be proportional to the pressure of the air, as would be expected in the presence of an emanation of constant strength, emitting penetrating rays. G. N. LEWIS.

The Determination of Molecular Weights. BY H. C. BIDDLE. *Am. Chem. J.*, 29, 341–352.—By a static method, the author determines directly the lowering of vapor pressure due to a solute. Two large flasks are exhausted and then partly filled, one with pure solvent, the other with a solution. Each is connected with one arm of a differential, olive oil manometer. Only solvents having vapor pressures above 225 mm. of mercury give satisfactory results. Data are given for a number of solutions in ether at 15°. Individual determinations differ usually several per cent. from the mean. For the molecular weight of iodine in ether, the value 257 is obtained. The author also describes the direct determination of the osmotic pressure of iodine in alcohol by means of a copper ferrocyanide membrane. The results lead again to the formula I_2. G. N. LEWIS.

Experimental Study of the Thermodynamic Relation between the Heat of Solution and the Change of Solubility with the Temperature in the Case of Dissociated Substances. BY A. A. NOYES AND G. V. SAMMET. *Ztschr. phys. Chem.*, 43, 513–538.—The authors show, mathematically, that the difference between the equations of van't Hoff and van Laar, which connect the heat of solution of electrolytes and their change of solubility with the temperature, lies essentially in the fact that the meaning of "heat of solution" is very different in the two equations. It means in the former, the heat of solution of one gram molecule of solute in just enough solvent to produce a saturated solution; in the latter, in an infinite quantity of a saturated solution. Allowing for this difference, the two equations become identical, except for a minor term which vanishes if the dissociation of the solute is assumed to follow the mass law, $\frac{(\alpha c)^n}{(1-\alpha)c} = \text{constant}$, where n, c and α represent, respectively, the number of ions produced by each molecule, the total concentration, and the degree of dissociation. This assumption seems to the reviewer not only

legitimate but logically necessary, for, in developing this mass-law formula from fundamental laws, two assumptions are made, namely, that both molecules and ions obey the laws of dilute solutions and secondly that neither are associated. But these are the very assumptions that are required in deriving the equation of van Laar as well as that of van't Hoff, in the form in which the latter is used by the authors.

In order to test, experimentally, the validity of the theoretical equations, the authors determined, on the one hand, the solubility at several temperatures and (by means of conductivity measurements) the degree of dissociation and its temperature coëfficient, for two different solutes; on the other hand, they determined the "total" heat of solution, as used in the van't Hoff equation. As solutes, *o*-nitrobenzoic acid and potassium perchlorate, both carefully purified, were used.

To test their calorimeter, the authors determined the heat of fusion of ice and incidentally obtained a new value, 78.8 cal., for this quantity. Without laying stress upon this exact value, they believe that their work indicates that the generally accepted value, 80.0 cal., is too high. The molecular heat of solution at 20° was found to be 6,025 cal. for *o*-nitrobenzoic acid, 12,130 cal. for potassium perchlorate. Calculated for the determinations of solubility and dissociation, 6,480 cal. and 12,270 cal. were found respectively. It is surprising that, while the two values for the latter solute agree within about 1 per cent., those for the former differ by 7.6 per cent., although it was to be expected that the agreement would be much closer for a weak acid than a salt. The authors believe, after a careful analysis of possible experimental errors, that it is very improbable that any one of the figures given is in error to 1 per cent., and, therefore, conclude that in the case of *o*-nitrobenzoic acid some of the original assumptions used in developing the equation are inapplicable. Association of the acid is offered as the most probable cause of the disagreement. It should be noted, however, that such association would affect the apparent dissociation constant, causing it to increase with dilution, while the experiments of the authors in every case show a decrease. The agreement in the case of the perchlorate is offered as evidence that the degree of dissociation is correctly determined by the conductivity method. G. N. LEWIS.

Optical Rotating Power of Camphor when Dissolved in Carbon Disulphide, Sulphur Monochloride, Phosphorus Trichloride and Sulphur Dioxide. BY HERMAN SCHLUNDT. *J. Phys. Chem.*, 7, 194–206.—Landolt found that if the curves connecting the specific rotatory power and concentration of camphor in a number of organic solvents were extended by extrapolation they all converged to the same value for 100 per cent. camphor, thus indicating that this value represents the specific rotatory power of pure camphor. The author, experimenting similarly with

solutions in CS_2, SO_2 and PCl_3, obtains 55.4, 55.6 and 54.8, respectively, for pure camphor. At the same temperature Landolt's value was 55.4. In all the solvents the specific rotation increases with the temperature and is greater, the greater the molecular weight of the solvent. G. N. LEWIS.

Rotatory Polarization Mechanically Produced. BY ARTHUR W. EWELL. *Am. J. Sci.*, 15, 363–388.—A cylinder of gelatine clamped at both ends and twisted, is found to acquire the power of rotating the plane of polarized light in a direction opposite to the twist. The magnitude of the effect is much increased by slipping a rubber envelope about the cylinder or by forming the cylinder inside a rubber tube. It is increased also by longitudinal compression of the tube, decreased by elongation, the logarithm of the rotation varying linearly with the length of a given tube. The rotation is greater the less fluid the jelly is. It is uninfluenced by hydrostatic pressure. It is approximately proportional to the fourth power of the twist. When the torsion is suddenly changed a decided lag in the rotation is observed. The author proposes a tentative theory for the phenomenon.

G. N. LEWIS.

Gaseous Constitution of the H and K Lines of the Solar Spectrum, Together with a Discussion of Reversed Gaseous Lines. By JOHN TROWBRIDGE. *Am. J. Sci.*, 15, 243–248; *Phil. Mag.*, 5, 524–529.—The author comes to the important conclusion that some of the most striking lines of the H and K groups in the solar spectrum do not belong to the calcium spectrum, as has been supposed, but to the spectrum of one or more of the gases existing in our atmosphere. This conclusion is supported by the following convincing arguments: These strong lines which appear in powerful discharges, in long Geissler tubes filled with hydrogen, are not due to the metal electrodes, for the lines of the electrode never appear more than two inches from the electrode either in discharges in air or in Geissler tubes. They are not due to the glass, for when glass is placed in contact with aluminum electrodes in such a way as to be much corroded by a discharge no calcium spectrum is apparent. Moreover, the same lines appear in tubes of pure quartz when no glass is present. Finally, these lines appear in discharges in air with a great variety of metal electrodes.

Likewise the author concludes that the strong, reversed lines which he has discovered in the ultra-violet, and which coincided with certain lines attributed to silicon, are also gaseous, for he obtains them in discharges in air with several metals as electrodes and even obtains them faintly from discharges with pure water electrodes, prepared by wrapping metal electrodes thickly with cotton and chamois skin wet with pure water. The author be-

lieves that these lines as well as those supposed to belong to calcium are due to oxygen. G. N. LEWIS.

Condensation of the Radioactive Emanations. BY E. RUTHERFORD AND F. SODDY. *Phil. Mag.*, 5, 561–576.—The radioactive emanations from radium and thorium, apparently of a gaseous nature, which the authors have previously shown to be unchanged in radioactivity, in rate of decay or in any other respect by the temperatures of white-hot platinum and of solid carbon dioxide, were subjected, in the experiments here described, to the temperature of liquid air with the following remarkable results. A stream of gas containing either kind of emanation, when passed through a coil at liquid-air temperature, emerges without a trace of radioactivity. If, now, the coil is warmed and a fresh stream of gas is passed through, the emanation once more appears in the issuing gas, showing that the emanation is not destroyed by cold but rather condensed in some way upon the walls of the tube. The quantity of the emanation is, moreover, uninfluenced by the condensation, for neither its radioactivity nor its rate of decay are affected. In order to determine the exact temperature of condensation, the gas carrying the emanation was led slowly through a coil of copper tube immersed in a bath of liquid ethylene of desired temperature. The electrical resistance of a part of the coil was used as a measure of the temperature. In other experiments a static method was used, by which the gas with the emanation was allowed to enter the spiral and after remaining there a certain time, was drawn off to the testing apparatus. Both methods give approximately the same results. In the case of the radium emanation, no trace remains volatilized below $-150°$, although less than one ten-thousandth of the whole amount used could be detected. An increase of temperature of one or two degrees causes a sudden volatilization of all the emanation. There is no sensible difference between the temperatures of condensation and of volatilization. Some experiments on the rate of volatilization at different temperatures show that the condensed emanation exerts a vapor pressure which apparently increases from ten to twenty times for every degree rise of temperature. In the case of the thorium emanation, the results were less simple. Its very rapid decay, which causes the radioactivity to diminish by one-half each minute, adds to the experimental difficulties. Furthermore, the rate of attainment of equilibrium is much slower than in the other case. For this reason the first experiments indicated a condensation point near that of the radium emanation, but more careful experiments showed the true temperature at which condensation begins to be about $-120°$, but below this temperature the condensation is comparatively slow. This difference in behavior between the two emanations is explained by the authors as due to

the difference in their concentration. They calculate that when the two produce equal effects the concentration of the radium, emanation is 5000 times as great as that of the other, and, other things being equal, the velocity of a change is greater when the concentration of the acting substance is greater.

From all these experiments the authors conclude that the two emanations are two different gases which are chemically and physically like ordinary gases except for their radioactive properties. This conclusion does not seem, however, to be entirely borne out by the experiments themselves. The sudden condensation of all the radium emanation within two or three degrees, which has since been verified by Curie and Daune (*Compt. rend.*, **136**, 1316), show that, if this is a true condensation of a vapor to the liquid or solid state, the vapor pressure must increase enormously with the temperature. This would indicate, according to Clausius' formula, a molecular heat of vaporization at least one hundred times that of any ordinary gas. G. N. LEWIS.

Radioactive Change. BY E. RUTHERFORD AND F. SODDY. *Phil. Mag.*, **5**, 576–591.—In this paper the authors, reviewing their previous work from a single standpoint, state in full their remarkable theory of the cause of radioactivity and the nature of radioactive change. Uranium, thorium and radium are not merely themselves radioactive but they produce other radioactive substances. Those from thorium and radium produce others and these still others through five distinct stages. All these products can be distinguished by the nature of the emitted rays, by the rate of decay, and by their apparent physical state (gaseous or condensed) and they are in no case produced in sufficient quantity to be detected by chemical methods or even by the spectroscope (cf. the remarkable discoveries recently made by Ramsay and Soddy; *Nature*, **68**, 246 and 354). The radioactivity of a substance A and the rate at which it produces the next substance, B, in the series, are both proportional to the amount of A and are dependent on no other conditions. The authors believe, therefore, that the radioactivity is not to be regarded as a property of the substance A but rather as an accompaniment to, and an integral part of, the change of A into B. Experiment indicates that the radiation is chiefly corpuscular in its nature, being composed of material particles positively charged. The theory is advanced that radioactivity is a manifestation of the disintegration of the chemical atom, that elements are being used up and others formed through a series of transmutations whose progress cannot be affected by any known agency, that, finally, elements are produced which do not change and which, therefore, not being radioactive, will elude investigation unless they can be accumulated in sufficient quantity to be subject to chemical tests. The important suggestion is made that, by a complete study of the natural minerals in which these

changes have probably been proceeding through geological epochs, we might learn much not only as to the nature of these end-products but also as to whether any of the present radio-elements are themselves products of the decay of others.

The authors calculate, not without questionable hypotheses, the rate at which the radio-elements are being consumed and the amount of energy which they emit. For radium, they calculate that one-tenth of one per cent. is used up every year. Hence they conclude that the radium is not as old as the mineral in which it occurs but is constantly produced in the mineral by some radioactive change. As a minimum estimate of the energy given out by radium, about 2 cal. per hour are calculated. The value found experimentally by Curie and Laborde (*Compt. rend.*, 136, 675) is about 100 cal. per hour. Holding to the doctrine of the conservation of energy there are two ways of explaining this stupendous evolution. We may suppose that some energy from without is converted in the presence of radioactive substances and becomes manifest as Becquerel rays, or, discarding this view, we must believe that some material change is taking place, such that an enormous change in internal energy is associated with the consumption of very small quantities of the changing substance. The authors discuss only the latter theory and show that it fits well their theory of the disintegration of the atom by which new elements are formed and old ones disappear. They believe that the change of internal energy in such a process is of a much higher order of magnitude than that accompanying any ordinary chemical process in which the atoms remain intact.

The question of the existence of other radio-elements such as polonium, radio-lead, etc., is discussed. It is pointed out that one important criterion of true radioactivity inherent in an element which has been separated by chemical methods is the permanency of the radioactivity. G. N. LEWIS.

The Cause and Nature of Radioactivity. Part I. BY E. RUTHERFORD AND F. SODDY. *Phil. Mag.* [6], **4**, 370–396 (previous work, this Review, **26**, 1, 110, and 295).—Thorium compounds by one precipitation with ammonia give thorium hydroxide having less than half of the radioactivity of the original substance. By evaporating the filtrate and driving off the ammonium salt, a very small, highly radioactive residue, ThX, is left. Nearly the entire amount of ThX is obtained in one operation, the filtrate from a second precipitation yielding but one per cent. as much as the first. The third operation gives a still smaller amount of ThX. The ThX so obtained possesses about 54 per cent. of the total radioactivity of the portion of substance from which it was separated. It seems to be a non-thorium type of matter possessing distinct chemical properties. It further possesses the property of exciting radioactivity on surrounding inactive matter; about 21 per cent. of its total activity, under ordi-

nary circumstances, is derived from this source. This excited radioactivity behaves like that produced by the thorium emanation. The activity of ThX is temporary. It falls to half value in four days and is very slight after three or four weeks. The rate of decay of the activity of ThX is entirely independent of its physical and chemical condition; the rate of decay is not altered by ignition or solution in acids and preservation in that form. Thorium hydroxide resulting from the first precipitation retains about 48 per cent. of its original activity. A considerable portion of the activity of this hydroxide is probably due to excited radioactivity. The hydroxide may be freed from excited radioactivity by 15 to 20 precipitations made at intervals of several hours. The minimum radioactivity is then 25 per cent. the total original value. The residual radiation of the hydroxide consists entirely of α-rays non-deviable by the magnetic field; while ThX and the excited radioactivity give both deviable and non-deviable radiations. The authors believe this residual activity is caused by a second non-thorium type of matter and that it should therefore be possible to separate it by chemical methods. Thorium hydroxide of minimum radioactivity regains its activity, rather rapidly at first, then more slowly, reaching its maximum value in about four weeks, after which time it will yield a further quantity of ThX. The rate of increase of activity of thorium compounds, free from ThX, is also entirely independent of physical and chemical conditions. These experiments lead to the conclusion that the radioactivity of thorium compounds at any time is the resultant of two opposing processes: (1) The production of fresh radioactive material at a constant rate by the thorium compound; (2) the decay of the radiating power of the active material with time. For equilibrium conditions, the radioactivity of all thorium compounds is the same and is independent of the source and the methods of purification. The phenomenon is, therefore, not due to impurities. In consequence, radioactivity is considered an atomic and not a molecular phenomenon.

H. N. McCoy.

Excited Radioactivity and Ionization of the Atmosphere. By E. Rutherford and S. J. Allen. *Phil. Mag.* [6], 4, 704–723.—The authors have studied the temporary radioactivity (discovered by Elster and Geitel) produced on a negatively charged conductor exposed to the open air. A long lead or copper wire was charged to negative potentials of from 5,000 to 100,000 volts and then, after winding it on a frame, brought into a closed cylinder. The ionization of the air in the cylinder so produced was measured by means of a quadrant electrometer. The effect decreases, with time, in geometrical progression, reaching half value in about forty-five minutes. The initial intensity of the excited radioactivity of the wire depended on the conditions during the charg-

ing. Differences of temperature and of the amount of moisture in the air have but little effect. The activity is greater on a bright, clear day than on a cloudy one. A windy day produces much greater effects than a quiet day. The amount of excited radioactivity increased with increase of voltage ; and for a given voltage increased at first roughly in proportion to the time, but reached a maximum after three or four hours. The maximum effect that could be produced inside a room was far less than that produced in the open air. The authors believe the radioactivity to be due to the deposit of a minute quantity of positive, intensely active material. From the fact that the radiation penetrates thin, aluminum plates better than the radiations from thorium or radium, the authors conclude that the deposit obtained from the air is not due to either of these elements.

A calculation based on the strength of the current flowing between two charged, concentric cylinders, as shown by a quadrant electrometer, lead to the conclusion that ions are formed at the rate of 15 per second in each cubic centimeter of air. From this and other data, it is calculated that each cubic centimeter of air, of a closed vessel, contains 2,600 ions. An approximate, experimental determination gave about one-third of this number. Determinations of the degree of ionization of air drawn from out-of-doors gave much smaller values, varying from 40 to 13 per cubic centimeter. It is suggested that the much greater ionization of air in closed vessels may be due to a radiation continuously emitted from the walls of the vessel. The velocity of migration of the positive ions of air was found to be 1.4 cm. per second, for a potential gradient of 1 volt per centimeter.

H. N. McCoy.

Excited Radioactivity and the Method of Its Transmission. By E. Rutherford. *Phil. Mag.* [6], 5, 95–117.—The phenomenon of excited radioactivity is shown only by thorium and radium. These are the only radioactive metals which give emanations. It was shown that excited radioactivity is caused by the emanation and is proportional to the quantity of the latter. Emanations behave like radioactive gases. The diffusion velocity of the radium emanation indicates a molecular weight between 40 and 100. Emanations themselves are not attracted by charged conductors and, therefore, are not considered as composed of electrically charged particles. On the other hand, a negatively charged conductor exposed to an emanation is soon coated with excited radioactivity. In the absence of a charged conductor, the excited radioactivity deposits on all surfaces in contact with the emanation. A positively charged conductor is not affected by the thorium emanation and is rendered only slightly active by the radium emanation. This leads to the conclusion that the carriers of excited radioactivity must be positively charged bodies. The

velocity of these carriers in a strong electric field was found to be 1.3 cm. per second, for a potential gradient of 1 volt per centimeter. This is about that of the positive ions produced in air by Röntgen rays. The author accounts for the production of positively charged carriers by supposing each particle of the emanation to expel from itself a negatively charged body of some kind. The remaining portion of the particle would then be positively charged. The excited radioactivity due to a short exposure to the thorium emanation, increases in intensity and in the course of several hours reaches a maximum of three or four times the value at the moment of removal from the emanation. It is thought that at least four distinct, successive chemical changes occur during the progress of the phenomena observed in the case of thorium. H. N. McCoy.

The Magnetic and Electric Deviation of the Easily Absorbed Rays from Radium. By E. Rutherford. *Phil. Mag.* [6], 5, 177–187.—Radium gives three kinds of radiations: α-rays, which ionize gases readily and are easily absorbed by thin aluminum plates; β-rays, which are strongly deviated by a magnetic field (these are similar to cathode rays and probably consist of negatively charged particles moving with high velocities); and γ-rays, which are non-deviable. The radiations are reduced one-half by an aluminum sheet 0.0005 cm. thick, in the case of α-rays; by 0.05 cm. for β-rays; and by 8 cm. for γ-rays.

Heretofore α-rays have been thought to be non-deviable; but it is here shown, by means of an ingenious device, for a description of which the original must be consulted, that in a sufficiently powerful magnetic field all the α-rays of a highly active radium preparation can be deviated. The extent of the deviation was found to be proportional to the strength of the magnetic field. The deviation occurs in the opposite sense to that of β-rays; α-rays are, therefore, positively charged particles. From the observed value of the strength of field for complete deviation, the velocity was estimated to be 2.5×10^9 cm. per second, or about one-tenth the velocity of light. The ratio of charge to mass is about 6×10^3. The α-rays of radium are very similar to the *Canal Strahlen* of Goldstein, but have somewhat greater velocity. It is thought that all α-radiations of uranium, thorium and radium, as well as of emanations and excited bodies are similar and consist of positively charged particles, moving with great velocities. The energy of the α-rays is about 1000 times that of β-rays.

H. N. McCoy.

Induced Radioactivity Excited in Air at the Foot of Waterfalls. By J. C. McLennan. *Phil. Mag.* [6], 5, 419–428.—The author compared the radioactivity excited on a wire charged negatively to 8,000 to 10,000 volts and exposed in the open air at Toronto with that excited on a wire exposed in the spray of

Niagara Falls. At Niagara, an electrical machine was not used, as the mist communicated to the wire a negative charge of 7,500 volts. The degree of excited radioactivity was determined with a quadrant electrometer, by measuring the ionization current produced in the air of a closed chamber, a fixed quantity of radioactive substance being used for standardizing. The radioactivity excited on the wire at Toronto was six to seven times as great as at Niagara Falls. The author thinks the negatively electrified spray attracts the constituents of the atmosphere which excite radioactivity, but on account of the large amount of the spray, the intensity of its radioactivity would be expected to be slight. No radioactive residue could be obtained by evaporating spray.

The radioactivity excitable in the wire exposed at Toronto varied considerable; wind increased the effect markedly; rain had little effect; but after a fall of snow the effect obtainable was greatly diminished. The residue from the evaporation of the freshly fallen snow was highly radioactive; that from snow two days old had but 2 per cent. of its original radioactivity. The author thinks this indicates that the excited radioactivity is due to an emanation from the earth's surface which is held back by the layer of snow. H. N. McCoy.

The Inclusion and Occlusion of Solvent in Crystals. By T. W. Richards. *Proc. Amer. Phil. Soc.*, **42**, 28–36.—All crystals deposited from solutions contain mechanically included portions of the solvent. The solvent thus included can not be removed by vacuum desiccation unless all cell walls inclosing droplets be ruptured. If the substance be finely powdered, with the hope of disintegrating all cell walls, the surface is so greatly increased that a considerable portion of the solvent may be retained by adsorption. It is probably impossible to completely remove included water from hydrated crystals, without also removing some of the water of crystallization. General methods of purification of crystals are suggested. It is pointed out that the inclusions in a mineral may be useful to the geologist as an indicator of the nature of the medium from which the substance crystallized.

H. N. McCoy.

On the Catalytic Decomposition of Hydrogen Dioxide and the Mechanism of the Induced Oxidations, Together with a Note on the Nature and Function of Catalase. By A. S. Loevenhart and J. H. Kastle. Part I, *Amer. Chem. J.*, **29**, 397–437.—The effect of numerous sodium, potassium, and ammonium salts and of hydrogen sulphide, prussic acid, urea, thiourea, and phenylhydrazine on the catalytic decomposition of hydrogen peroxide by silver, platinum, thallium, copper, iron, and catalase was studied by observing the rate of evolution of oxygen. In some cases the rate of catalysis was changed but little by the addition of one of the first mentioned group of substances to the

hydrogen peroxide mixed with the catalytic agent. In other cases there was a marked difference, some increasing the catalytic action, others almost completely preventing it. The effect was most noticeable when the inhibiting agent was a substance with which the catalyzer might possibly combine to form an insoluble body. Thus the activity of finely divided silver is destroyed or greatly decreased by the presence of potassium bromide, ammonium chloride, ammonium thiocyanate, hydrogen sulphide or prussic acid. It was found that a substance which inhibits the decomposition by one catalytic agent may have the opposite effect on the action of a different catalyzer. The authors believe that the effect of any particular substance on the catalyzer can be explained, in the majority of cases at least, upon purely chemical grounds. The action of inhibitors on finely divided metals is thought to be due to the formation of thin films of insoluble compounds on the surfaces of the metallic particles. The action of certain inhibitors may be of a different nature. They may destroy hydrogen peroxide by reducing it directly or may, by decomposition, yield substances which have specific inhibitory action. It is thought that the inhibitory action of various substances in no way indicates a real analogy between inorganic and organic catalyzers.

From the results obtained by the oxidation of formaldehyde and formic acid, by the action of hydrogen peroxide in the presence of various catalytic agents, the authors are led to conclude that, in general, any substance that can effect the decomposition of hydrogen peroxide can also accelerate, to a proportional extent, oxidations by means of this substance. Hydrogen peroxide does not oxidize a neutral solution of potassium oxalate in the presence of platinum black or liver catalase. This fact is thought to be evidence that hydrogen peroxide, in decomposing, does not liberate atomic oxygen. H. N. McCoy.

The Catalytic Decomposition of Hydrogen Peroxide. By J. H. Kastle and A. S. Loevenhart. Part II, *Amer. Chem. J.*, **29**, 563–588.—The authors review the literature on the action of hydrogen peroxide, as an oxidizing agent, and discuss known reactions in the light of the views expressed in the preceding articles regarding the mechanism of the oxidations. They look upon catalytic agents which promote oxidation by hydrogen peroxide as substances which can combine with the latter to form complex, unstable holoxides. In the presence of suitable reducing substances these unstable derivatives may act as oxidizing agents, or, in their absence, they may undergo decomposition into molecular oxygen, water, and the original catalytic agent or an oxidation product thereof. The function of Loew's catalase in plants is also discussed. H. N. McCoy.

Some Applications of the Theory of Electrolytic Dissociation to Medicine and Biology. BY W. D. BANCROFT. *Electrochemical Industry*, May, 1903 (a lecture before the American Philosophical Society).—Certain solutions have a toxic action on certain plants or animals; it is found that the toxic action is in many cases due to a certain ion. The physiological effects of a substance are, however, a function of the degree of saturation as well as of its ionization; at equal concentrations, the ionized salt is usually more active than the un-ionized. Many reactions are accelerated by the presence of the hydrogen ion of dissociated acids; the free hydrochloric acid in the stomach assists the pepsin to act on albumen, and experiments have shown that the amount of catalytic assistance is proportional to the concentration of the hydrogen ions. Acetic acid is not dissociated 1 per cent. as much as hydrochloric, and, therefore, could not be substituted for it in this process of digestion. The acid in the stomach comes from the salt in the blood, and since hydrochloric acid will diffuse away from sodium chloride through a membrane, if the salt is mixed with another acid, such as lactic or acetic, the secretion of hydrochloric acid by some glands is more likely to be a case of selective diffuson of ions than any specific secretive power of the glands. The decomposition of hydrogen dioxide into water and oxygen is accelerated by colloidal metals, organic ferments and blood corpuscles. The colloidal metals have been called inorganic ferments; one milligram of platinum in 300 liters of water has a noticeable effect. It is, therefore, possible to explain why traces of arsenic in the thyroid gland are essential to health, and the necessity of iron in the system. Diffusion of liquids through semi-permeable membranes gives rise to osmotic pressures of several atmospheres, in dilute solutions; this pressure is one important factor in the rise of sap in trees, for it alone would theoretically cause sap to rise 140 to 150 feet. In surgery, the abdominal cavity is now washed out with a salt solution of such strength as to cause no osmosis through the cell walls with which it comes in contact; when pure water was used, the osmosis into the cells frequently caused them to become turgid and burst. This physiological salt solution should contain about 0.9 per cent. of salt, in order to be in osmotic equilibrium with the blood inside the cells. J. W. RICHARDS.

INORGANIC CHEMISTRY.

The Rare Earth Crusade, What it Portends, Scientifically and Technically. BY CHARLES BASKERVILLE. *Science*, 17, 772–781.—This paper represents an address delivered before the Chemists' Club, New York, April 8, 1903. The author presents an historical account of the most important work on the rare

earths from the discovery of gadolinite in 1788 to the present time. H. N. McCoy.

The Action of Ozone, Hydrogen Peroxide, Etc., on Carbon Monoxide. By W. A. Jones. *Am. Chem. J.*, 30, 40–50.—Carbon monoxide when mixed with air and passed over wet sticks of phosphorus is oxidized to carbon dioxide to the extent of about 2 per cent. That this result is not due to the intermediate formation of hydrogen peroxide was shown by passing carbon monoxide over phosphorus wet with a solution of hydrogen peroxide, when no oxidation occurred. Carbon monoxide was not oxidized by a 63 per cent. solution of hydrogen peroxide alone. Carbon monoxide was slowly oxidized by ozonized oxygen at the ordinary temperature and more rapidly at 250°. The gas contained 3.78 per cent. of ozone and was produced by a Berthelot ozonizer and a coil giving a 16-inch spark. Electrolytic oxygen does not oxidize carbon monoxide. H. N. McCoy.

The Action of Ozone on Carbon Monoxide. By C. E. Waters. *Am. Chem. J.*, 30, 50–53.—Because the results obtained by Jones (preceding article) did not confirm previous work on the action of ozone on carbon monoxide, the author repeated Jones's experiments, using instead of the induction coil a Holtz machine, but otherwise employing the same apparatus. It is concluded that although ozone does not act on carbon monoxide as readily as we should expect from its apparent unsaturation, still it does cause some oxidation to carbon dioxide, depending upon the amount of ozone in the oxygen. The oxidation does not take place to an appreciable extent at the ordinary temperature.

H. N. McCoy.

On the Oxidation of Siloxicon. By Edward G. Acheson. *Electrochem. Ind.*, 1, 273.—Siloxicon is of variable composition, approaching, however, Si_2C_2O. When it is heated, in an atmosphere rich in oxygen, it is oxidized above 1468° C., giving silica and carbon dioxide. In a reducing atmosphere, it is stable up to very high temperatures, when it decomposes, giving carborundum and probably silicon vapor and carbon monoxide. Carborundum behaves like siloxicon when heated in an oxidizing atmosphere. H. N. McCoy.

Notes on Recent Scientific Developments Abroad. By W. J. Hammer. *J. Franklin Inst.*, May and June, 1903.—A lecture giving many recent facts respecting radium, polonium, actinium, selenium, and their applications. J. W. Richards.

On the Existence of a New Element Associated with Thorium. By Charles Baskerville. *J. Elisha Mitchell, Sci. Soc.*, *18th Year, Part 1*, pp. 1-16. W. F. Hillebrand.

Arsenic Pentachloride. By Charles Baskerville and H. H. Bennett. *Ibid.*, pp. 29-31.—The above papers have appeared under the same titles in this Journal, 23, 761 and 24, 1070.

W. F. Hillebrand.

MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

The Ore-Deposits of Sudbury, Ontario. By Charles W. Dickson. *Trans. Am. Inst. Min. Eng.* (Albany Meeting, Feb., 1903) 65 pp.—This very thorough study is divided into two parts: (1) The relation of nickel to pyrrhotite, and (2) genesis of the Sudbury ores. Based on many experiments in concentration by himself and others, and on numerous analyses of the various products, he seems to demonstrate several facts: That the nickel occurs in the ores as pentlandite and not as an isomorphous replacement of the iron in the pyrrhotite; that the ratio of the metals to sulphur in the pentlandite is not 1:1 as supposed, but 11:10, and that of the nickel to the iron also nearly 11:10 (Ni:Co, 42:1); that the formula of the Sudbury pyrrhotite is generally Fe_8S_9, though occasionally Fe_7S_8 and Fe_9S_{10}; that, while nearly all the pentlandite can be separated from the pyrrhotite by magnetic methods, its separation commercially is out of the question; that pyrrhotite and magnetite can be fairly well separated by a 10 per cent. solution of nitric acid.

Wide differences of opinion obtain as to the origin of the Sudbury ores. By evidence of a largely different character from that advanced by others in favor of their secondary origin, namely, microscopical revelation of the relations between the ores and the rock minerals, the author has become fully convinced that the theory of direct igneous origin is untenable, and that their secondary origin, as in the case of the pyrrhotite deposits of Rossland, B. C., and Ducktown, Tennessee, is now placed beyond question, though a slight preliminary concentration of the metals with the intrusion of the norite is admitted as possible. A great number of reasons are given in support of his conclusion. Little can, as yet, be said regarding the paragenesis of the sulphides.

W. F. Hillebrand.

The Garnet Formations of the Chillagoe Copper Field, North Queensland, Australia. By George Smith. *Trans. Am. Inst. Min. Eng.* (Advance extra, New York Meeting, Oct., 1903), 12 pp.—Several varieties of lode-formation present themselves in this field, of which the garnet type is the most important. The writer seems to regard the garnet not as due to metamorphism of the neighboring limestone by contact with intruding granite, but as an independent injection of igneous origin. The magnetite often accompanying it "could then, perhaps, be explained as the result of magmatic segregation of the excess of iron pres-

ent, beyond that required for the garnet. The presence of the copper could possibly be accounted for in a similar manner." An analysis of the garnet shows: SiO_2, 40.5; Fe_2O_3, 11.1; Al_2O_3, 16.7; CaO, 31.6; CuO, 0.3; MnO, MgO, traces; total, 100.2.

W. F. HILLEBRAND.

Bentonite. BY THOS. T. REED. *Eng. and Min. J.*, **76**, 48. —The properties and uses of the peculiarly plastic and absorptive clay brought to notice by W. C. Knight in Vols. 63 and 66 of the *Eng. and Min. J.*, and named by him, are here given in greater detail. It promises to be largely used as a retarder for the hard-finish plaster for finishing walls, and is used to adulterate cheap candies, besides forming with glycerine the patent preparation "phlogiston," a protective dressing in cases of croup and pneumonia. It finds also other employment. Its composition is: SiO_2, 60.18; Al_2O_3 and Fe_2O_3, 26.58; CaO, 0.23; MgO, 1.01; Na_2O, 1.23; K_2O, 0.00; H_2O, 10.26; total, 99.49; sp. gr., 2.2 when air dry. It is derived from anorthosites in the archean core of the Laramie Mountains. Albany County, Wyoming, is the type locality, but it is found also in Carbon, Natrona, Crook, and Weston Counties. W. F. HILLEBRAND.

The White Country Granite of West Sugarloaf or Bald Mountain, Boulder County, Colorado. BY CARL D. HENRY. *Proc. Colo. Sci. Soc.*, **7**, 112–116.—This is a further, but very meagre, contribution to the knowledge of the eruptive rocks of Boulder County (see this Journal, **20**, R 5, and **24**, R 71). The rock is faintly pinkish, and the most prominent phenocrysts are of quartz, muscovite, epidote, and labradorite. Analysis afforded J. B. Annear: SiO_2, 71.434; Al_2O_3, 16.800; Fe_2O_3, 1.215; FeO, 0.157; MnO, 0.218; CaO, 0.990; MgO, 1.423; K_2O, 3.48; Na_2O, 3.42; H_2O, 0.85; P_2O_5, 0.35; total, 99.337; sp. gr., 2.559.

W. F. HILLEBRAND.

Chrysocolla: A Remarkable Case of Hydration. BY CHARLES M. PALMER. *Am. J. Sci.*, **16**, 45–48.—Attention is drawn to the large amount of loosely held water in specimens of chrysocolla from Arizona. Exposure over sulphuric acid resulted in losses of 18.96 and 20.54 per cent. without change in the color of the powder. More than the amounts lost were subsequently regained in a moist atmosphere. These same specimens yielded, in addition, 8.32 and 8.60 per cent. of water at a low red heat. It is suggested that in some of the older analyses of chrysocolla showing lower total percentages, this hygroscopic water may have been overlooked. W. F. HILLEBRAND.

The Mechanics of Igneous Intrusion. BY REGINALD A. DALY. *Am. J. Sci.*, **16**, 108–126.—In this second paper on the same subject, further concrete illustrations are offered in support

of "a hypothesis on the development of the larger magma chambers now occupied by plutonic rocks" (see abstracts in this Journal, **25**, R 272, 273), and there is further discussion of some of the main premises on which the hypothesis is based.

W. F. HILLEBRAND.

On the Formula of Bornite. BY B. J. HARRINGTON. *Am. J. Sci.*, **16**, 151–154.—Five analyses of massive bornite and one of the crystallized mineral gave the following results agreeing with the formula Cu_5FeS_4 instead of that hitherto accepted, Cu_3FeS_3.

	I.	II.	III.	IV.	V.	VI.	Cu_5FeS_4.
Cu	63.55	62.78	62.73	63.34	63.18	63.24	63.27
Fe	10.92	11.28	11.05	10.83	11.28	11.20	11.18
S	25.63	25.39	25.79	25.54	24.88	25.54	25.55
Insol.	....	0.30	....	0.38	0.24	....	....
	100.10	99.75	99.57	100.09	99.58	99.98	100.00
Sp. gr. 15°	5.085	5.055	5.090			5.072	

I. Harvey Mill, P. Q. II. Bruce Mines, Ontario. III. Dean Channel, Howe Sound, B. C. IV. Copper Mountain, South Fork of Similkameen River, B. C. V. Texada Island, B. C. VI. Bristol, Connecticut.

The older analyses of Cornish material by Plattner, Varrentrapp, and Chodney, and two new ones by the author, do not conform closely to the formula Cu_3FeS_3. The older and the now available Cornish specimens were far from pure, being not only superficially oxidized but contaminated by chalcopyrite as well. "There is then good reason for believing that the formula Cu_3FeS_3 was deduced from analyses of impure material...."

W. F. HILLEBRAND.

Significance of Silicic Acid in Waters of Mountain Streams. BY W. P. HEADDEN. *Am. J. Sci.*, **16**, 169–186.—Artesian and spring-waters of the San Luis Valley, in Colorado, were found to carry silica to the extent of 25 to upwards of 40 per cent. of their total mineral matter. The water of the Rio Grande at Del Norte "was richer in silicic acid than is usual for river waters, and richer here than further down the stream." The waters of the Cache a la Poudre (and other streams draining the eastern slopes of the Rocky Mountains) show similar large, relative amounts of silica at points above where tributaries enter "whose waters are not wholly gathered within and run for their whole course over an area whose surface rocks are the metamorphic granites and schists of the region." "The conditions under which these waters occur preclude the application of the theory advanced to explain the presence of silicic acid in the waters of geysers and hot springs in general." Their temperature is low, they do not issue from, nor probably in any part of their course do they pass through rocks of volcanic origin, except superficially in a few instances. They are essentially surface waters. The analyses reported by the author show no peculiarity other than

the excessive relative amount of silica, far above that of river, lake, and spring-waters generally. No source for their mineral contents other than the feldspars of the granites and schists of the drainage areas seems admissible or possible, and no other solvents can have acted than the water itself and carbonic acid, unless perhaps in small degree the contained organic matter. From his own experiments the author believes the influence of this last to be insignificant. It would then seem that this high silica percentage in the mineral contents of mountain streams flowing over siliceous areas must be a normal condition, and to test this experiments were made with powdered feldspars in contact with water, the whole being agitated with a current of air mixed with a little carbon dioxide. The solutions thus obtained were evaporated and the residues analyzed, with results which seem to favor the view above expressed. Comparison of the composition of the residues with that of the feldspar used in the experiments shows that with only 0.31 per cent. of lime as against 11.59 of potash and 2.73 of soda in the latter, the percentages of these constituents in the residue in one case were 10.24, 10.97, and 5.25. These figures make plain the far greater solubility of the lime-soda molecules than of those containing potash. From the great excess of acidic over basic radicals in the natural waters and the artificial extracts, it is concluded that the silicic acid must exist in the free state. The facts thus developed "easily account for the silicification of vein matter and the deposition of chalcedonic quartz, etc., in veins and elsewhere," and the characteristic presence of strontia and lithia in the waters finds at the same time a ready explanation.

W. F. HILLEBRAND.

Variolitic Pillow-Lava from Newfoundland. BY REGINALD A. DALY. *Am. Geologist*, **32**, 65–78; plates, figures.—In connection with the description of a new occurrence, the origin of variolite and the pillow structure is discussed. W. F. HILLEBRAND.

The Upper Red Beds of the Black Hills. BY GEORGE B. RICHARDSON. *J. Geol.*, **11**, 365–393; map, figures.—The upper red beds or the Spearfish formation are described as to stratigraphy, microscopical characteristics, and chemical composition. Based on the latter and on microscopical examination, the mineral composition is judged to be about: Quartz, 41; muscovite, 20; kaolin, 10; calcite, 9; magnesite, 8; feldspars, 5; hematite, 3; gypsum, 2; magnetite, ilmenite, chlorite, 2; total, 100. Analyses are also given of a very pure gypsum and of the water of a salt spring, all analyses being by Geo. Steiger, of the United States Geological Survey. There is a discussion of the causes of coloration of red beds in general and of those of the Spearfish formation specifically. It is deemed probable "that the dominant factor in the production of the color of the red beds of the Black Hills was a

residual, red soil on the land mass which supplied the sediments," with conditions of climate and vegetation tending to minimize the reduction of the ferric matter during sedimentation. Green spots and streaks in the red shales, the color of which is due to lower ferric oxide and higher ratio of ferrous to ferric oxide than in the red parts, are caused by the reduction of the higher oxide by organic matter locally present in the sediments, and removal of the resulting ferrous compound in solution.

W. F. HILLEBRAND.

Notes on the Geology of Mount Kearsarge, New Hampshire. BY JOSEPH H. PERRY. *J. Geol.*, 11, 403–412; figures.—Descriptions and analyses without titanium or phosphorus, are given of the Conway granite, which makes up the base of Mt. Kearsarge and the spur called Mt. Bartlett, and of four varieties of quartz porphyry above. An intervening granite-porphyry was not analyzed. These three were formed by the solidification of a single magma. The Conway granite is characterized by the readiness with which it crumbles, on weathering, into a gravelly débris of orthoclase and quartz, by reason of the greater solubility of the plagioclase and mica, aided by the action of frost.

W. F. HILLEBRAND.

The Chemical Composition of Limestones from Upraised Coral Islands, with Notes on Their Microscopical Structures. BY ERNEST W. SKEATS. *Bull. Mus. Comp. Zool.*, *Geol. Series*, 6, 51–126; figures. Reprinted, with additions, from the copy privately issued in 1902.—For the purpose of studying the extent and causes of dolomitization in upraised coral islands, a great number of specimens collected by various expeditions have been examined microscopically and chemically. Many islands show little dolomitization, others are dolomitized from top to bottom, and the two conditions may occur together. "Perhaps the occurrence of dolomitization is most usual at the highest points of the islands." "Many of the dolomitic limestones, in composition, approach to, and even slightly exceed, 40 per cent. of magnesium carbonate. But it is an interesting circumstance that, up to the present, no rock having the composition of a true dolomite has yet been met with among the limestones from coral islands. The maximum value for magnesium carbonate yet recorded is 44.3 per cent., from one of the Christmas Island rocks." While occasional extensive deposits of phosphate rock are met with, the amount of calcium phosphate found in the limestones does not exceed 0.3 per cent. and is often much less. "Organic residue is found only in the most recent and unaltered rocks, and is then present in amount up to 1.5 per cent." The insoluble residue is very low, as a rule varying from 0.01 to 0.2 per cent., the exceptions being those cases which are associated with volcanic rocks, and "these facts may be found to be of use in interpreting the mode

of origin of some of the older limestones of the earth's crust." The structural and mineralogical changes which the coral formations undergo in process of time are interesting and have received much study. The method of Meigen (*Centralbl. f. Min.*, 1901, 577–578)—boiling the powder with solution of cobalt nitrate—was used with success to distinguish between calcite and aragonite, and that of Lemberg (*Ztschr. d. deutsch geol. Gesell.*, **40**, 357 (1888)) for calcite and dolomite when the microscope alone failed. Almost the only one of the various theories proposed to account for the dolomitization of coral limestones that is not opposed to the facts recorded seems to be that of Dana, and it is suggested that some modification of it "will be found to harmonize more closely with the evidence than any view which has, as yet, been put before geologists." W. F. HILLEBRAND.

Notes on the Theories of Origin of Gypsum Deposits. BY R. S. SHERWIN. *Trans. Kansas Acad. Sci.*, **18**, 85–88.—Objections are raised to the theory of formation of gypsum deposits in Kansas and Oklahoma by the evaporation of lakes and seas. The author prefers to seek the source of the calcium in large limestone beds east of the gypsum deposits, and of the sulphur in the waters of springs which may have existed. W. F. HILLEBRAND.

Gold in Kansas Shales. BY J. T. LOVEWELL. *Trans. Kansas Acad. Sci.*, **18**, 129–133. **Gold in Kansas.** BY J. T. LOVEWELL. *Trans. Kansas Acad. Sci.*, **18**, 134–137.—In these papers, written about a year apart, are many statements as to the assay value and mill-run returns in gold and silver of shales from Western Kansas. The presence of zinc is repeatedly affirmed. See, however, this Journal, **24**, R 522. W. F. HILLEBRAND.

Report of the Section of Chemistry and Mineralogy. BY G. CHR. HOFFMANN. *Ann. Rep. Geol. Survey of Canada*, **12**, 1900, Part R, 67 pp.—Besides analyses of chrompicotite, faujasite, native antimony, edenite, and magnesite, there are notes on asbestos, azurite, bismuthinite, native copper, cuprite, lampadite, malachite, melaconite, rutile, native tellurium, tremolite and uvarovite, besides the usual numerous analyses and assays of limestones, coals, marls, waters, ores of iron, nickel, cobalt, gold, silver, etc. The magnesite above mentioned occurs in some parts of Argenteuil County, Township of Grenville, in abundance as a rock-forming mineral. Nearly all of the analyses of it show considerable calcium carbonate. W. F. HILLEBRAND.

Petrography of Some Igneous Rocks of the Kettle River Mining Division, British Columbia. BY L. P. SILVER. *Ottawa Naturalist*, **17**, 85–91.—Most of the specimens described represent andesites or related rocks. Chemical data are wanting.

W. F. HILLEBRAND.

Oil Fields of the Texas-Louisiana Gulf Coastal Plain. BY C. W. HAYES AND WILLIAM KENNEDY. *U. S. Geol. Survey, Bull. No. 212*, 174 pp.; maps, plates. W. F. HILLEBRAND.

Catalogue and Index of the Publications of the United States Geological Survey, 1901 to 1903. BY P. C. WARMAN. *U. S. Geol. Survey, Bull. No. 215*, 234 pp. W. F. HILLEBRAND.

Chemical Analyses of Igneous Rocks Published from 1884 to 1900, with a Critical Discussion of the Character and Use of Analyses. BY HENRY STEPHENS WASHINGTON. *U. S. Geol. Survey, Professional Paper No. 14*, 495 pp.—The character of this most important work, a fit successor to Roth's Tabellen, the last instalment of which appeared in 1884, is in large measure indicated by its title, but a few sentences from the Letter of Transmittal to the Director of the Survey by Whitman Cross, geologist in charge section of petrology, may well be reproduced. "This work is primarily a compilation of chemical analyses, and is especially valuable to petrographers and chemists, for it places in one volume material gathered from a great many scattered sources. The critical discussion of the value and use of rock analyses, with comments on methods of analysis and a review of the bearing of this mass of material upon rock classification, is also of much importance to petrographers and chemists. The arrangement of the analyses according to the quantitative system for the classification of igneous rocks (see this Journal, **25**, 319, and R, 7) permits one to compare readily any new analysis with many others of closely allied rocks. A work of this kind is necessarily very expensive when published by a commercial house, and if so issued would be beyond the reach of many who would desire to use it. It is particularly appropriate that the Survey should publish this work, because a very large proportion of the rock analyses here included have been made in the laboratory of the United States Geological Survey, upon material which is preserved in its petrographic reference collection."
W. F. HILLEBRAND.

Building and Ornamental Stones of Washington. BY S. SHEDD. *Part I of Ann. Rep. Washington Geol. Survey, Vol. II, 1902*, pp. 1–163; plates.—Analyses are given of granites, tufas, sandstones, marbles, and serpentines. W. F. HILLEBRAND.

Coal Deposits of Washington. BY HENRY LANDES AND C. A. RUDDY. *Part II of Ann. Rep. Washington Geol. Survey, Vol. II, 1902*, pp. 165–277; map, figures. W. F. HILLEBRAND.

Copper Deposits of New Jersey. BY WALTER HARVEY WEED. *Ann. Rep. State Geologist of New Jersey, 1902*, pp. 125-139.—Developments of late years in the workings of the American Copper Co. near Somerville have shown that with depth the oxi-

dized ores, which have furnished most of the copper mined in the state during and since colonial days, change to native copper, a fact which possibly augurs well for the revival of mining in the region, provided the average content should exceed $1^1/_4$ per cent. The deposits occur for the most part in the upper part of an altered shale underlying overflows of a chloritized basalt. The "facts are believed to show that the copper comes from the basalt; that the solutions carrying it contained alkaline carbonates, and precipitated copper and glance with calcite. If the copper came from decomposing chalcopyrite of either the shale or basalt, the solution would be acid and calcite attacked. Where organic matter, such as plant remains, occurred, the copper sulphide would be reduced to native copper." From the complete absence of ferric oxide with the copper and the occurrence of the latter, "*only* in those portions of the ore bed in which the ferric oxide has been reduced" it is evident that the active reducing agent was not a ferrous salt, but must have been of an organic nature. The following reaction is suggested: $Cu_2S + C + H_2O + 5O = 2Cu + H_2SO_4 + CO_2$. W. F. HILLEBRAND.

Production of Graphite. BY J. STRUTHERS. *Iron Age*, May 28, 1903 (advance sheets of report U. S. Geological Survey, 1902). —The output of manufactured graphite in 1902 was 2,358,000 pounds, of which 1,475,000 pounds were in granular or powdered form, and 883,000 pounds as graphitized electrodes. The average value was 4.69 cents per pound. Of natural graphite, the United States output in 1902 was 1209 tons of amorphous, valued at $19,764, and 4,176,842 pounds of crystalline, valued at $153,147. Details of occurrence and production in Canada are also given.

J. W. RICHARDS.

The Burro Mountain Turquoise District. BY G. D. REID. *Eng. Min. J.*, May 23, 1903.—The bulk of the United States market is supplied from this district, on the northern edge of the Burro Mountains, in Grant County, N. M. In 1882, the Occidental and Oriental Turquoise Mining Co., began to operate the mines, but it was not until 1901 that the popularity of "turquoise matrix" created a large demand, and since then the "Gem Turquoise and Copper Company," successor to the first-named company, has mined continuously, and sends weekly shipments of fine gem material to New York. The Azure Mining Co. employs fifteen men at a shift, and has been operating continuously for eleven years. The country rock is granite, with the feldspars extensively kaolinized towards the outer edges of the district. The turquoise occurs in small seams or veinlets, or as nodules in the country rock, the latter giving the best stones. Most of the mining is done in open cuts or by chaneling. The gem material brings from $5 to $10 per carat, at retail. J. W. RICHARDS.

Asphalt Rock in Kentucky. By W. E. Brock. *Eng. Min. J.*, June 27, 1903 (*from adv. sheets of Mineral Industry*).—The "black-rock" strata contain up to 4 per cent. of bituminous matter, and are of no commercial value, the intervening asphaltic strata are 3 to 15 feet in thickness and contain 5 to 15 per cent. Of the total bituminous content, one-fifth is asphaltene and four-fifths petrolene. After the bitumen is extracted, the sandstone which it impregnated falls to a very fine powder. Only the deposits near the railways are being worked. For street composition, the rock is crushed at or near the quarries, and mixed, when used, with pulverized limestone or marl and an asphaltic cement composed of Trinidad gum asphalt or petroleum residue. Details are given respecting the various deposits. The value of the output in 1902 was $68,704. J. W. Richards.

ANALYTICAL CHEMISTRY.

Refractometers and Some of Their Uses in Analytical Chemistry. By W. F. Edwards. *Proc. Colo. Sci. Soc.*, 7, 85–102; figures.—Devoid of original matter. The author regards it as very unfortunate that arbitrary scale instruments are in use in the case of fixed oils and fats. He wishes that instrument makers would furnish them with tables whereby the readings could be used to find the index of refraction, and that investigators would use these tables instead of publishing arbitrary numbers. W. F. Hillebrand.

Report of the Committee Appointed by the Ohio Gas Light Association to Determine Standard Methods of Testing Fuel Gas Appliances. *Amer. Gas Light J.*, 78, 842–889.—The committee, Messrs. H. L. Doherty, F. W. Stone, and John Franklin, give rigid methods for determining the efficiency of instantaneous and independent water heaters, and of the top-burners, ovens, and broilers of gas-ranges. All of these appliances are made to heat water flowing at such a rate as to be discharged at a fixed temperature. The conditions under which this is to be done for each appliance and the apparatus for it are given in much detail. The efficiency is to be determined for varying rates of consumption of the gas; it is to be stated in per cent., and is determined by dividing the total heat added to the water by the total heat the gas is capable of developing. This last quantity is to be determined by calorimetric measurement or by calculation. The losses are due in all cases to radiation and to the sensible heat carried off by the products of combustion, this being divided into necessary loss and that due to over-ventilation. In the case of ovens, the committee adds the loss due to incomplete combustion, which may be determined by analysis of the products of combustion. The losses due to sensible heat carried off are determined

by multiplying the rise in temperature of the flue gases by the quantity of each constituent and its specific heat, and then adding these products together. For making the flue-gas analysis, the committee recommends the Orsat apparatus. (This recommendation seems unfortunate to the reviewer, because in the Orsat apparatus oxygen can be completely removed only by passing the gas to be analyzed a great number of times back and forth between burette and absorption bulb. The point of complete removal is very difficult to observe, because the decrease in volume after each absorption, except the first few, is very slight. All of the oxygen that is not removed by the alkaline pyrogallol is absorbed by the cuprous chloride solution and thus appears in the analysis as carbon monoxide.) The necessary heat loss is obtained by calculation, and the difference between this value and the one found for the total heat lost through the products of combustion gives the loss due to over-ventilation. The loss due to radiation should be represented by the difference between the total heat the gas is capable of developing and the sum of the heat added to the water and that carried off by the products of combustion. In the case of ovens, the committee would determine the radiation by finding the length of time it takes to melt enough ice in the oven at room temperature to yield two pounds of water. An alternative in determining the efficiency of the top-burner is to find how much water it will cause to evaporate in a given time with varying rates of gas consumption.

BENTON DALES.

A System of Qualitative Analysis, Including Nearly All the Metallic Elements. Introduction. Part I. **Preparation of the Solution.** BY A. A. NOYES. *Technology Quarterly*, 16, 93–131. —This is a preliminary publication of an investigation which has been carried on during the past three years by Professor Noyes and a number of co-workers. The work is being pursued on a broad and strictly experimental basis and promises to be by far the most notable contribution to qualitative analysis that has appeared for many years.

The scope and plan of the undertaking is indicated in the following quotations from the introduction :

"The aim of this investigation has been to work out in detail a systematic, universally applicable scheme of qualitative analysis which shall include as nearly as practicable all the metallic elements, and which shall make possible their detection even when present in quantities as small as 1 or 2 milligrams."

"The system of analysis will be primarily divided into a series of parts: Part I will treat of the preparation of the solution; Part II of the analysis of the tungsten and niobium groups ; Part III of the analysis of the selenium and silver groups ; Part IV of the analysis of the platinum group and the detection of lead and tellurium ; Part V of the analysis of the ruthenium, iridium, copper,

and molybdenum groups; and the succeeding parts, of the rare earth, aluminum and iron, alkaline earth, and the alkali groups. Under each part is first presented a tabular outline which will give a survey of the important steps and the chemical reactions involved in the procedure. This is followed by a general discussion in which are presented the reasons for the adoption of the process employed. Then comes the procedure itself, and the explanatory notes upon it. Next are presented confirmatory experiments and references, which serve to substantiate the statements made in the notes and to justify the details of the procedure. Finally are given the test analyses, which were made with known mixtures according to the procedure, in order to test its efficiency."

In Part I, which forms the subject of the article, radical departures are made from the ordinary course of procedure in the preparation of solutions for the detection of the metals. The paper is so replete with details that it can hardly be given in abstract. THEODORE WHITTLESEY.

A Study of the Quantitative Determination of Antimony. BY LEWIS A. YOUTZ. *School of Mines Quart.*, **24**, 135–144.—The work here described was undertaken with the hope of finding a method of separation of tin from antimony, analogous to Fischer's method of separating arsenic chloride by distillation. Stannous chloride dissolved in aqueous hydrochloric acid does not volatilize, except in traces, at the boiling-point of the solution, even when the boiling-point is raised to 150° by adding zinc chloride.

Stannic chloride volatilizes slowly and partially from a solution containing zinc chloride above 125°, in a stream of hydrogen chloride. Antimony trichloride behaves similarly under the same conditions, the volatilization becoming appreciable at a slightly lower temperature. Solutions of antimony salts oxidized with either nitric acid or potassium chlorate are not volatile at 145°. No analytical separation of antimony and tin could be effected by distillation. H. N. McCOY.

Notes on the Ammonium Molybdate Precipitation of Phosphorus. BY J. W. BEATTY. *Iron Age*, May 28, 1903.—Precipitations were made in different menstrua, *viz.*, nitric acid, hydrochloric acid, ammonium nitrate with free nitric acid, ammonium chloride with free nitric acid, and ammonium chloride with free hydrochloric acid. The results were all satisfactory; the only differences were the longer time necessary for settling of the precipitate when using hydrochloric acid. An ammonium molybdate solution was made up with hydrochloric acid instead of with the usual nitric acid, and precipitations were likewise satisfactory in either nitric acid or hydrochloric acid solutions, except that longer time was necessary for complete settling in the bottom.

J. W. RICHARDS.

Loss of Sulphur in Pig-Iron Borings. By W. E. Dickson. *Iron Age*, June 11, 1903. (Read before the American Foundrymen's Association.) The discovery was made that carefully kept borings lost sulphur on standing, some very old samples having lost as much as 40 per cent. of their total sulphur content. The loss is probably due to slow oxidation. Steel standards show no loss, possibly due to their rolling up into compact lumps which present little porous surface. J. W. Richards.

Electrochemical Analysis: Determination of Lead as Dioxide. By I. Moltkehansen. *Electrochemical Industry*, June, 1903.—The writer made tests to find the exact quantity of free nitric acid which should be in solution to separate lead from manganese satisfactorily, and the limits of accuracy of the method. By using high current density, strong acid, and a hot electrolyte, the manganese is kept in solution as permanganic acid, while lead is precipitated on the anode as PbO_2. There must be less than 1 Mn to 2 Pb to get a clean separation, but the method would appear to be useful in many cases, such as analyzing galena. With less than 0.03 gram Mn present, and over 0.1 gram Pb, the electrolyte should contain 25 to 27 cc. of nitric acid (sp. gr. 1.42) to 150 cc., corresponding to 18 per cent. pure HNO_3; electrolysis is started at 70° C., with 2 amperes to 150 sq. cm. anode area. If as much as 0.04 gram Mn is present, either more HNO_3 is added, say 35 cc. of 1.42 acid, or else 25 to 27 cc. is added as before and a few cubic centimeters of oxalic acid solution are added as soon as flakes of manganese hydroxide form in the electrolyte. The analysis takes thirty-five to fifty minutes. The anode is washed well with water, dried, and weighed. No lead comes down on the cathode as long as the amounts of nitric acid mentioned are added. J. W. Richards.

On the Present Status of the X-Rays. Use in Qualitative Analysis. By M. I. Wilbert. *J. Franklin Inst.*, June, 1903.—X-rays have been found of considerable use in detecting adulterations of inorganic materials in drugs or chemicals of organic origin; drugs like the gums, gum resins and resins are rather difficult to examine in the ordinary way, but may be readily tested by these rays. In coal, asphalt and other materials of a like character, the amount as well as the distribution of the ash or inorganic material may be readily determined. In cases of medical and surgical treatment, the use of these rays has more than come up to the expectations, and bids fair to be of even more use; the technical and applied scientific purposes for which they are suitable have not been so thoroughly exploited as they deserve. J. W. Richards.

The Commercial Assay of Lead Ores. By A. W. Warwick. *Proc. Colo. Sci. Soc.*, 7, 109–111.—The author defends against at-

tack the position assumed by him at an earlier date (this Journal, 25, R 274) and offers further evidence to prove that the fire assay for lead gives much lower results than the wet assay, especially on poor ores. See also in this connection this Journal, 25, R 122.

W. F. HILLEBRAND.

METALLURGICAL CHEMISTRY AND ASSAYING.

Louisiana Purchase Exhibition: Metallurgical Exhibits. *Iron and Mach. World*, May 16, 1903.—The general article of sixteen pages describes the exhibition in detail, with fine illustrations. Director Skiff writes on *Exhibits at the Exposition*, H. T. Rogers on *Exhibits of Technical Schools*, J. Ockerson on Civil, Military and Architectural Exhibits, T. M. Moore on the *Department of Machinery*, W. E. Goldsborough on the *Department of Electricity*, W. A. Smith on *Transportation Exhibits*, and J. A. Holmes on *Mining and Metallurgical Exhibits*. Many of the modern metallurgical processes will be shown in actual operation, and some of the most primitive apparatus also, such as the Mexican *Arrastra*.

J. W. RICHARDS.

Industrial Pittsburg. BY W. G. IRWIN. **Recent Growth of Cincinnati.** BY R. H. SHERWOOD. *Iron and Mach. World*, May 16, 1903.—A timely résumé of the resources and productiveness of these districts, in the various metallurgical and allied industries.

J. W. RICHARDS.

On the Industrial Importance of Metallography. BY A. SAUVEUR. *J. Franklin Inst.*, April, 1903.—A lecture confined to the metallography of iron and steel. Cast iron is to be regarded as very high carbon steel plus a certain amount of graphitic carbon. The close relation between structure, treatment and properties cannot be detected by chemical analysis, but only by microscopy; it is of as great importance to impart the right structure to a metal as to secure for it a desirable composition. Mr. Kreuzpointner, in the discussion, thought that it would be some time yet before we could tell the working qualities of a steel simply by the microscope. Mr. G. H. Clamer has made considerable use of this new method of investigation on other metals than iron and heartily endorses Sauveur's statements as to its practical importance.

J. W. RICHARDS.

A Modern Method of Coal Washing. BY C. A. MEISSNER. *Eng. Min. J.*, May 9, 1903 (paper before Nova Scotia Mining Society).—Descriptive of an apparatus which can be applied to concentrating ores as well as to washing coal. The specific gravity of pure coal is 1.0 to 1.3, of slate 2 to 2.7, pyrites 3.1 to 5.1. Successful action is entirely dependent on uniformity of size. The coal is passed through a grizzly to $^1/_4$ inch, and then passed from a hopper into a chute, where it is washed onto the beds by a

1-inch stream of water. The beds are 9 feet long by 30 inches wide, hung loosely by rods at the corners, the head end being connected to a rocker arm which gives it a bumping motion. The bed has riffles of triangular strips of oak $^1/_8$ inch apart, set like saw teeth. The whole resembles a trough with a serrated bottom. The bed bumps about 60 times per minute against the bumping-post at the head end, causing the slate and pyrites to accumulate against the bottom and to be gradually discharged at the upper end, while the coal is washed over the lower end. A fan-shaped sheet of water is introduced the whole width of the bed, at the upper end, to wash back any larger pieces of coal which may be carried up that far. The fine pyritic flakes and other pulverized, heavy impurities smaller than $^1/_8$ inch pass between the riffles, and discharge separately through the bottom. Each bed delivers 5 tons of washed coal per hour, washing out about 4 per cent. of refuse. The refuse carries 30 to 40 per cent. of coal. The arrangement is called the Campbell washer, and the average cost per bed is about $50. J. W. RICHARDS.

Retort Oven-Coke for Foundry Use. BY W. J. KEEP. *Iron Age*, June 11, 1903 (read before American Foundrymen's Association).—Has used retort oven-coke exclusively, for eighteen months, melting 80 tons of iron a day, and found it eminently satisfactory. Experience has shown that with a retort oven a satisfactory foundry coke can be made from some coals, which when coked in a bee-hive oven would give a coke which would be unfit for foundry use. An 80-oven plant is being erected in Milwaukee, which will greatly benefit the local foundries.

J. W. RICHARDS.

Comparative Tests of Beehive and Retort Coke. BY E. A. UEHLING. *Iron Age*, June 11, 1903.—When the same coal is used, retort coke contains more moisture than beehive coke, from its being quenched outside the oven; it is also shorter, more uniform in size and very much denser; the yield averages 10 per cent. greater. It is entirely without the metallic luster of beehive coke, but in firmness is altogether its equal. A test was made on a furnace making 230 tons of iron per day, which was run four days on each kind of coke, made from the same coal. There was no difference in the quantity of iron produced, but the iron from retort coke averaged 1.06 silicon and 0.039 sulphur, against 1.10 silicon and 0.035 sulphur for the other iron. The fuel requirement was 1743 pounds of retort coke per ton of pig iron, and 1885 pounds beehive coke; the ratio of CO to CO_2 in the gas was also less for the former, indicating better working. Many instructive tables accompany the paper. J. W. RICHARDS.

A New Charcoal Cooling Process. BY B. ZWILLINGER. *Iron Age*, June 11, 1903.—A proposition to cool the hot charcoal in kilns, after charring, by means of cold gases obtained by distill-

ing wood in closed retorts. The gases are about one-third carbonic oxide and two-thirds carbon dioxide, and are driven through a cooling apparatus, and then into the kiln to be cooled. When again cooled, they can be again used, and so circulate until the contents of the kiln are cool enough to be drawn. The kilns can thus be drawn in a few hours after the charring is finished, instead of having to stand several days to cool off.

J. W. RICHARDS.

Organization and Management. BY A. CARNEGIE. *Iron Age*, May 7, 1903 (presidential address at the May meeting of Iron and Steel Institute). J. W. RICHARDS.

American Conditions and Competition. BY A. SAHLIN. *Iron Age*, May 7, 1903 (an appendix to the Report on the Manufacture of Pig Iron in America. Read at the conference of the British Iron Trade Association, March 31, 1903).

J. W. RICHARDS.

Hollow Pressed Axles. BY C. MERCARDER. *Iron Age*, May 7, 14, 1903 (paper read at the May meeting of the Iron and Steel Institute). An account of the development of the manufacture of railroad axles on a large scale at the Homestead Steel Works. J. W. RICHARDS.

Iron Ore Deposits of Cuba. *Iron Age*, June 4, 1903.—An abstract of a special report prepared for the War Department, under the supervision of Dr. David T. Day, of the United States Geological Survey. J. W. RICHARDS.

Test Drilling on the Mesaba Ore Range. BY K. THOMAS. *Eng. Min. J.*, June 13, 1903.—This range is two to five miles wide and over 100 miles long; about 5 per cent. of this area is underlaid by ore. Each 40-acre tract is tested by putting one hole in the center and one near each corner, 300 feet towards the center. If adjoining tracts are tested by the same parties, the alternate tracts have the corner test holes replaced by holes at the middle of each side, 300 feet towards the center, thus spacing the holes more regularly. The cores are analyzed every three to ten feet. The cost is $3 to $3.50 per foot for ordinary drilling, and $5 to $6 per foot for diamond drilling. When quartzite is struck, the hole is drilled no further; it is also usually abandoned when slate is struck, but ore is occasionally found below slate. The whole iron formation is seldom thicker than 300 feet; near Hibbing, one hole is 350 feet in solid ore. J. W. RICHARDS.

Test Drilling on the Vermilion Iron Range. BY K. THOMAS. *Eng. Min. J.*, June 23, 1903.—Exploration is here more difficult than on the Mesaba range. Few of the deposits have outcrops, and some of the best mines have been discovered only by drilling. The usual depth of holes is 600 to 1000 feet, and the cost is $3.75 to $5

per foot, according to the depth and character of the formation. The drilling is not done vertically, but at a dip of 45° to only 15°, so as to cross the inclined formation as nearly at right angles as possible. The rate of progress daily is 1 to 5 feet in the hard jasper, 10 to 15 feet in hard ore, and 10 to 30 feet in the greenstone. The limit of possible iron is supposed to be the diorite under greenstone. J. W. RICHARDS.

New Discoveries of Iron Ore. *Iron and Mach. World*, May 23, 1903.—Valuable iron ore discoveries are said to have been made recently on an offshoot of the western vermilion field, near Graves Lake, north of Deer River. On the Mesaba range, drillers are working over the field formerly explored by churn drills, and by using diamond drills and going through the taconite schist are finding many valuable ore bodies.

J. W. RICHARDS.

The Baraboo Iron Ore District. *Iron and Mach. World*, May 30, 1903.—The Illinois Iron Mining Company are opening up valuable mines on the Baraboo River, Wisconsin. There are some 50 to 75 diamond drills at work, and much high-grade ore has been found. One mine has a deposit 100 feet wide, with some 2,000,000 tons of high-grade ore in sight. Analyses show 55 to 70 per cent. iron, with phosphorus low enough for Bessemer grade. In some places the deposits are 300 feet thick.

J. W. RICHARDS.

Pittsburg's Early Furnaces. *Iron and Mach. World*, May 9, 1903.—A description of the building and operation of the first furnaces in the Pittsburg district, *viz.*, Anshetz's furnace, built in 1792 and run only two years, and the Clinton stack, built in 1859. J. W. RICHARDS.

Use of all Mesaba Ore. *Iron and Mach. World*, May 9, 1903. —The first of the new blast-furnaces of the Clairton Steel Company has been successfully started, using 100 per cent. Mesabi ores. The use of so much *fine*, *soft* ore has been made possible by keeping the diameter of the furnace 21 feet, but lowering its height to 85 feet. The production averages 500 tons daily. The outcome will be cheaper pig iron, or a consequent increased value of the Mesaba deposits estimated at $100,000,000.

J. W. RICHARDS.

The Iron Industry of the Birmingham District. BY S. S. KNIGHT. *Iron Age*, June 18, 1903 (read before the American Foundrymen's Association).—A description of the iron-ore mines, coal and coke supplies, limestone quarries, blast-furnace plants and steel works of this region. It is estimated that $33^1/_2$ billion tons of coal are in this district, which would, however, only smelt half of the iron ore in it. The iron ore is in many cases brought

to the stock house for less than $1.00 per ton; 70 cents is the lowest cost. It contains 40 to 50 per cent. of iron, with phosphorus from 0.10 to 1.25 per cent. An unlimited supply of nearly chemically pure dolomite is to be had, at a cost of not over 65 cents per ton in the stock house. Transportation rates to Liverpool are $3.25 per ton. The writer thinks that this will become the cheapest iron- and steel-producing center in this continent.

J. W. RICHARDS.

Blast-Furnace Conditions Affecting the Chemical Composition of Foundry Iron. BY W. W. DAVIS. *Iron Age*, June 11, 1903 (read before American Foundrymen's Association).—An iron high in silicon and low in sulphur will have almost all its carbon in the state of graphite, but the amount of manganese, temperature of iron as it leaves the furnace, rate of running and manner of cooling, all affect the question. Further, the iron running out varies at one cast, as much as 1.27 per cent. variation in the silicon and 0.28 per cent. in the sulphur being noticed at one cast, but manganese and phosphorus vary much less. The use of casting-ladles and machines obviates these irregularities. Specifications should leave latitude in silicon and sulphur, and not specify too many constituents, for frequently one conditions the other.

J. W. RICHARDS.

The Quality of Pig Iron for Foundry Use as Shown by Fracture and Analysis. BY S. B. PATTERSON. *Iron Age*, May 21, 1903 (read before the New England Foundrymen's Association).—An agreeable address on the generalities of this subject, presenting it in a clear manner. Concerning titanium, the author states that it usually occurs in pig iron, up to 0.4 per cent., without any bad effects on the iron; the principal detriment is the action of the titanium on the slag in the manufacture of the iron.

J. W. RICHARDS.

A Device for Ascertaining Average Silicon in a Foundry Iron Mixture. BY A. W. WALKER. *Eng. Min. J.*, June 20, 1903 (read before American Foundrymen's Association).—A mechanical device to save calculation. A balanced scale has a single beam on one side and several beams on the other. On each of these several beams may be hung a weight proportional to the silicon content of a certain iron and at a distance proportional to the weight of that iron used in a ton of mixture. When all the weights in a ton of mixture are thus properly placed, the counterweight on the other side is moved to a balance, and then indicates the average silicon percentage in the mixture. In a foundry using a fixed charge of a ton, and a few fixed brands of pig iron of constant silicon content, the device would be useful to the melter, to avoid arithmetical errors.

J. W. RICHARDS.

Specifications for Foundry Pig Iron. BY H. E. FIELD. *Iron and Mach. World*, May 16, 1903.—A discussion of the present attitude of purchasers and sellers of pig iron, and the specifications which the writer considers would be practical, sufficiently liberal for any well-managed furnace to fill, and restrictive enough to guarantee to the founder the product which he desires.

	For stove-plate and like work.	For light machinery.	For medium machinery.	For heavy machinery.
Silicon.....	over 3.00	over 2.75	over 2.50	over 2.25
Sulphur....	under 0.03	under 0.035	under 0.04	......
Phosphorus	0.8 to 1.20	0.6 to 1.0	under 0.04	under 0.60
Manganese.	less than 0.5	less than 0.5	0.5 to 0.9	0.7 to 1.1

J. W. RICHARDS.

The Bertrand-Thiel Steel Process. *Iron and Mach. World*, May 2, 1903.—The Clairton Steel Company at Clairton, Pa., controls the American rights to this process. They will erect ten furnaces, five primary and five secondary, all on the same floor level, the metal being drawn from the primary into a ladle and thence transferred to the secondary. J. W. RICHARDS.

The Development of the Continuous Open-Hearth Process. BY B. TALBOT. *Iron Age*, May 14, 1903 (paper read before the Iron and Steel Institute, May, 1903).—A record of the running of the 200-ton furnace, working at the Jones and Laughlin Steel Works, Pittsburg. The liquid blast-furnace iron is of hematite quality, containing 0.1 per cent. phosphorus, making it standard Bessemer metal. The furnace lining is magnesite bricks, with calcined magnesite fused on. Natural gas is used. The furnace can be tilted without shutting off gas or air. The furnace is 40 feet between ports, 17 feet 6 inches wide in the center, and 14 feet 6 inches at the ends. The surface area is 640 square feet. The average charge is 100,000 pounds of liquid pig iron, 12,000 pounds of dry scale (70 per cent. iron, 10 per cent. sulphur), 6,000 pounds of lime, 450 pounds ferro-manganese. The average yield, in ingots, is almost exactly equal to the pig iron and scrap used. There is no appreciable elimination of sulphur from the charge. J. W. RICHARDS.

Artificial Abrasives: Crushed Steel. *Iron and Mach. World*, May 9, 1903.—Principally a description of the manufacture and use of *crushed steel*. High-grade crucible steel is heated to 1400° C. and chilled in water; it is then crushed under heavy rollers or hammers to a fairly uniform size. The particles are tempered by heating to 250° C., cooled by a current of cold air, and graded by sieving. The finest size is called *crushed steel emery*. Under a magnifying glass each particle is seen to have numerous sharp points or cutting angles, and as these are worn away in use the grains fracture and present new cutting angles, making them useful until completely destroyed. After being exhausted, the residue can be saved, remelted, and used over. J. W. RICHARDS.

The Rolling and Structure of Steel Rails. BY P. DUDLEY. *Metallographist*, April, 1903 (report to N. Y. C. and H. R. R. R. Co.).—Photomicrographs of various rail steels are shown, with the number of granulations estimated per square inch. Steel should wear well under the tread of the wheels, and have the high elastic limit necessary for the rail as a girder. Colder rolling gives a finer granular structure. The first effort must be to produce sound ingots, so as to get sound metal for the head of the rail. Most rails are finished too hot. The reheating of ingots for rolling should be carefully watched, being checked by frequent photomicrographs of the steel to detect overheating. Too cold rolling increases the deflection sets on the drop test, showing that the elastic limit has been reduced, injuring the rails as a girder. Highest speed trains often cause fiber strains of 40,000 to 50,000 pounds per square inch in the base of 80 pound rails, even when the track is in the best condition, and, therefore, elastic limits should test well above this. This advantage is particularly true of nickel steel rails, which have hardness combined with great toughness and high elastic limits. While the stiffness of rail sections has increased of late years up to 100 per cent., the axle load effects, and consequent strains on the rail have increased in even a faster ratio, and rails of higher elastic limits are a necessity for present service. In the working of steel, the striving for fine granulation and consequent high-wearing qualities must not be made at the expense of lower elastic limits.

J. W. RICHARDS.

The Influence of the Rate of Cooling on the Structure of Steel. BY A. SAUVEUR AND H. C. BOYNTON. *Metallographist*, April, 1903 (read before American Institute Mining Engineers). —A steel bar containing 0.52 carbon was heated to 1100° C. and cooled slowly in the furnace or rapidly in air. The quickly cooled steel showed microscopically a sharply defined net-work structure; the slowly cooled showed a granulated structure. The dark constituent occupies a larger proportion of the section of the air-cooled sample, some 90 per cent. against 50 per cent. in the other, so that, calling it pearlyte, it is evident that the carbon is segregated into smaller bulk in the slowly cooled steel. Examination of this pearlyte at 1000 diameters magnification showed the laminated structure well developed in the slowly cooled steel, but imperfectly developed, with ill-defined structure at places, in the other. The cause of the difference must be that time was not allowed in the latter case for the complete segregation of the two constituents, cementite and ferrite, into a lamellar structure. To induce the formation of true pearlyte, the metal must be cooled sufficiently slowly from 900° C. or thereabouts, to and past the critical point; the rate of cooling below the critical point is immaterial. Mechanical tests of the two samples showed the slowly cooled to have a lower elastic limit and tensile strength, but

greater elongation and reduction of area. The amount of carbon in a steel cannot be judged from the area occupied by the pearlyte unless the rate at which the sample has been cooled be known.

J. W. RICHARDS.

Probable Existence of a New Carbide of Iron, Fe_2C. BY E. D. CAMPBELL AND M. B. KENNEDY. *Metallographist*, April, 1903 (read before Iron and Steel Institute, 1902).—The greater part of the carbon in annealed steel exists as Fe_3C., but all the carbon is not recovered in this form owing to the decomposition, on analysis, of the carbide remaining in solid solution—the dark portions of the pearlyte. To see what was the composition of such solid solution of carbon, a piece of white iron was annealed by heating, in an atmosphere of hydrogen, up to 950° C., in five hours, keeping at that temperature two hours, and cooling in three hours more to 600° C. The original iron contained 3.53 combined carbon and 0.01 graphite; after annealing, the graphitic carbon had increased only to 0.12 per cent. The block was then made anode in a N/4 solution of sulphuric acid, with platinum cathodes, and a current of 0.3 ampere passed through. Every twenty-four hours the block was brushed clean, taken out and weighed, and the separated carbide filtered out, washed in water, alcohol, and ether, and dried at 250° in hydrogen. Analyses of this carbide showed 6.52 to 9.45 per cent. of carbon, and represented a total of 80.76 per cent. of the carbon in the iron treated. Some of the carbide was ground and sieved; the fine sievings contained 8.80 to 9.87 per cent. of carbon. Since Fe_3C contains only 6.67 per cent., and Fe_2C would correspond to 9.67 per cent., it seems probable that the carbide obtained was a mixture of these two carbides. The conclusion is that the annealing converted the pearlyte into a dark matrix which contains carbon in solid solution, probably as Fe_2C; and a white constituent, probably cementite, containing Fe_3C.

J. W. RICHARDS.

Strength of White Iron Castings as Influenced by Heat Treatment. BY A. E. OUTERBRIDGE, JR. *J. Franklin Inst.*, April, 1903 (read before Am. Soc. for Testing Materials).—The author describes curious, soft spots of perfectly gray iron found on the tread of chilled car wheels, the dividing line between the white and gray portion being, in all cases, sharply defined. After investigating, it was found that flames impinged directly upon some of the castings in the annealing pits, causing a complete change from combined carbon to graphitic wherever the flames touched. The specific gravity of the iron in the soft spots was 7.80; that of normal, gray metal of corresponding composition 7.20. The total carbon was the same in both. The commercial practice of annealing white iron castings into dense gray iron with high tensile strength, capable of being hardened and taking a sharp cutting edge, is no longer a secret, and heat treatment

alone is relied on to produce the desired results. The case of conversion of white iron into dense gray iron by annealing depends almost entirely on the presence of silicon, a few tenths of a per cent. will not suffice, but at 0.9 to 1.20 per cent. very good conversion is obtained. The temperature of conversion is approximately 1,850° F., being between the melting-points of silver and copper; the change of carbon at this temperature is uniform throughout the section, no surface conversion or hard unconverted core is observable. The graphitic carbon thus formed is very different from ordinary graphite, either crystallized or amorphous, and is an allotropic form of graphite; Ledebar has called it "tempering graphite carbon." The castings thus treated can be forged and subsequently hardened on the cutting edges, and so have properties closely resembling steel; but it is a misnomer to call them either steel castings or malleable iron castings.

Malleable Cast Iron. By R. Moldenke. *Iron Age*, June 11, 1903 (read before American Foundrymen's Association).—The present production of malleable castings is 650,000 tons per year, at least half of which goes into car construction. The castings are originally cast chilled, contracting some 1¼ inches per foot, the annealing then expels the carbon from its combined state and deposits it between the crystals of the iron, not as graphite but in an amorphous form not unlike lampblack; at the same time the casting expands about ⅝ inch per foot, the net result in shrinkage from the patterns being thus about the same as for gray iron. Besides this change, carbon is removed entirely from the outer skin, and partially to a depth of about ¼ inch. It is probable that the carbon diffuses outward, rather than that oxygen diffuses inward and burns it. Carbon is used as low as 2.75 in the castings, and must chill without leaving any graphite. Sulphur should not be over 0.05, although 0.10 may be present and still not entirely spoil the castings. Manganese is seldom over 0.40 in the iron, which means 0.10 to 0.20 in the finished casting; over 0.40 begins to make trouble in the annealing. Phosphorus should not exceed 0.225, and is better less than this. Silicon should not exceed 0.45 in very heavy work, or 0.65 in ordinary work, but lightest castings may have 0.8, 1.0 or even 1.25 per cent. without danger. Only a good laboratory can keep the manufacturer from much trouble. In America the reverberatory, or air-furnace is mostly used, but the open-hearth, regenerative gas-furnace is more economical for large plants, and is being introduced. Making short, sharp heats, the silicon is only reduced 0.20 to 0.25, instead of the usual 0.35 or more. American practice in annealing is to aim at converting the carbon into the soft variety rather than to remove it. 680° C. is the lowest temperature to be used, 780° C. is the best, but cupola-melted iron requires 850° C.

J. W. Richards.

The Schwartz Furnace for Malleable Cast Iron. *Iron Age*, June 18, 1903.—A report of test made in Chicago. 1000 pounds of charge, consisting of 600 pounds No. 2 charcoal pig iron, 325 pounds Stewart coke pig iron, and 75 pounds of steel scrap, were melted, with an air pressure of 2 pounds, in ninety-five minutes, yielding 940 pounds of metal, a loss of 6 per cent. Another charge run from 70 per cent. Bessemer "malleable" pig and 30 per cent. soft steel scrap was cast into 1-inch square test bars, which were then annealed, and showed 35,760 and 39,620 pounds tensile strength, and were quite tough and malleable. It is claimed that repairs will cost only 10 to 15 cents per ton on these furnaces. A furnace is being built to make steel castings, some test-bars having been already made, with satisfactory results.

J. W. Richards.

The Copper Deposits of the Beaver River Range, Utah. By H. M. Crowther. *Eng. Min. J.*, June 27, 1903.—The principal structure is eruptive, and thermal springs have been active. The ore veins are either fractures in igneous rocks, or shear-fissures in igneous-sedementary contacts, or contact deposits in limestone. Bodies of sulphide ores up to 16 feet wide and averaging 40 per cent. of copper have been opened up, and the average ore of the region is rated as 6 per cent., with some gold and silver. Chalcopyrite is the main ore, though oxidized ores are also plentiful, but too silicious to smelt alone.

J. W. Richards.

Smelting of Raw Sulphide Ores at Ducktown, Tenn. By W. H. Freeland. *Eng. Min. J.*, May 2, 1903.—The practice consists of two operations, carried out alternately in the same furnace: (1) Smelting of the low-grade copper ore to a low-grade matte, about 20 per cent. copper. (2) The reconcentration of the low-grade to a 50 per cent. matte. The furnace is a Herreshoff water-jacket, $8^1/_2$ feet deep by 21.7 square feet cross-sectional area at the tuyeres, with the regular fire-hearth replaced by a water-cooled blast-tapping spout and an ordinary brick-lined settler 5 feet by 4 feet by 18 inches deep. A test run, very carefully made, gave interesting data. The first concentration lasted $16^1/_2$ days, smelting 1,120 tons of ore, 89 tons quartz, 162 tons slag = 1371 tons burden; with 38 tons of coke = 2.77 per cent. of the burden. The ore is a pyrrhotite, containing 2.74 Cu, 36.52 Fe, 24.85 S, 18.55 SiO_2, 7.29 CaO, 2.67 MgO, 2.56 Zn, 0.91 Al_2O_3, 0.77 Mn, 3.14 CO_2. The slag formed agreed very closely with its calculated composition, containing Cu, 0.37; Fe, 38.84; S, 1.74; SiO_2, 32.60; CaO, 8.24; MgO, 3.44; etc. The matte produced contained Cu, 20.0; Fe, 47.15; S, 24.00; SiO_2, 0.44, etc. The second concentration lasted seventy hours, there being added some raw ore to keep down the tenor of final matte. The second slag contained Cu, 0.60; Fe, 43.99; S, 1.19; SiO_2, 33.72;

CaO, 2.03; etc. The second matte contained Cu, 49.63; Fe, 25.24; S, 23.00, etc. Including both operations, the furnace averaged 60 tons of raw ore per day. The first concentration was 7.3 to 1, the second 2.5 to 1. The degree of concentration is proportionate to the speed at which the furnace is driven, and is controlled by the proportion of quartz in the charge, or variation of blast, or both. The average air was 4500 cubic feet per minute, at 17 oz. pressure. At the tuyeres, a porous, friable accretion is allowed to form and bridge the furnace from wall to wall, with clear spaces for the descent of the charge between. The tuyeres are usually dark. The vertical section would show accretions at the sides at the tuyeres reaching almost to the center of the furnace. The effect of this condition is that the charge, resting upon these artificial boshes, undergoes a partial roasting in its descent and a rapid, fierce oxidation as it passes through the constricted channels between the tuyeres. The slags run hot and fluid, and the furnace gives less trouble than those alongside smelting roasted ore. The total coke consumption, in the two operations, is only 4.4 per cent. of the weight of raw ore smelted. The slag carries, in the two operations, the equivalent of 0.45 per cent. copper. The flue dust was 53 pounds per ton of original ore. Despite the reduced tonnage, the author is very well satisfied with the results thus obtained in smelting raw ore.

J. W. RICHARDS.

Cost of Mining and Smelting at Butte, Montana. BY "OCCASIONAL CORRESPONDENT." *Eng. Min. J.*, May 9, 1903.—The ores average 3.2 per cent. copper, 50 per cent. silica and 16 per cent. iron. From testimony given under oath in some recent litigation, it appears that the cost of mining is \$3.18 per ton at one mine, and \$3.50 per ton at another; transportation varies from 15 to 20 cents; crushing and sampling from 20 to 50 cents; concentration 70 to 75 cents; calcining 22 to 33 cents; matting 97 to 177 cents per ton. The total cost of treatment, to production of matte, is from \$2.61 up to \$3.35 per ton of ore. Matting in blast-furnaces costs nearly 50 per cent. more than in reverberatory furnaces, at the Butte and Boston works. J. W. RICHARDS.

The Copper Sulphate Deposits of Copaquire, Chile. BY E. WALKER. *Eng. Min. J.*, May 9, 1903.—The sulphate occurs in the hydrated form in thin, irregular veins, disseminated through the rocks over a large area, the rocks being chiefly decomposed porphyry. The region has been subjected to volcanic action, and earthquakes are of frequent occurrence. A characteristic sample showed hydrated copper sulphate 12.77 per cent., copper carbonate 1.53, copper sulphide 0.39, iron sulphide 1.07, Fe_2O_3 4.45, Al_2O_3 (chiefly as sulphate) 2.11, $CaSO_4$ 6.51, $MgSO_4$ 4.47, MnO 0.26; the remainder insoluble in water or acid. The total percentage of copper is about 4.44. The only feasible

method of treatment so far proposed (fuel and water being very scarce) is to dissolve out in water, evaporate by solar heat and ship the anhydrous sulphate to the coast. J. W. RICHARDS.

Treatment of Low-Grade Copper Ores. BY E. D. PETERS. *Eng. Min. J.*, June 6, 1903 (Discussion before Institution of Mining Engineers).—The only processes practiced are (1) *Direct Smelting*: This is the preferable way where practicable. Slags as low as 30 per cent. lime and magnesia and only 16 per cent. ferrous oxide are practicable, with concentration of 20 and even 30 tons of ore to 1 ton of matte. This method saves almost all the copper and precious metals; it would be impracticable in absence of silver and gold, non-existence of limestone for fluxing, and high cost of fuel. (2) *Mechanical Concentration*: This is followed by smelting of the concentrates and lixiviation of the tailings; it is only suitable for exceptional ores and conditions, and many difficulties and failures have been met in its application. The copper mineral is frequently so finely disseminated that concentration is impracticable; it is in most cases more economical to subject the entire mass of ore at once to lixiviation. (3) *Lixiviation of the Ore Direct, with Ferrous Chloride and Salt*: Ores other than oxidized ores must be first crushed dry and thoroughly roasted. By using modern high-speed rolls of large diameter and automatic reverberatory roasters, the cost of this operation should not exceed the cost of wet-crushing and concentration, and the roasted ore is in much better condition for leaching. The operation is that of the old Hunt and Douglas method. (4) *Direct Lixiviation with Hydrochloric and Sulphuric Acids, Which Are Regenerated by Precipitation by Sulphur Dioxide*: This is the new Hunt and Douglas method. The copper is gotten into solution by leaching the ore with the acids named, and then treated with SO_2 which throws down the copper as heavy white CuCl, regenerating the acids. The solution attacks roasted ore energetically; lead and silver remain undissolved. A supply of pyrites is essential to the economical working of this method. (5) *Direct Lixiviation with Sulphuric Acid*: This is more feasible upon the whole ore (crushed and roasted) than upon fine tailings and slimes, and much more economical. J. W. Neil uses sulphurous acid to leach ores, converting the copper of oxide and carbonate ores directly into cuprous sulphite, Cu_2SO_3, soluble in excess of acid, and precipitated, by boiling off the excess acid, as a dark-red cuprous-cupric sulphite containing 49 per cent. copper. This salt is filtered out, washed, dried, and reduced to copper by melting on the hearth of a reverberatory furnace. Sulphide ores are first roasted; sulphur dioxide is obtained by roasting pyrites or the ore. No scrap iron is needed for precipitation. (6) *Rio Tints Heap Lixiviation*: Where the climate is suitable and chemical and physical conditions of the ore permit, this process is slow but cheap. The heaps burn slowly four to

six months, and are then leached for about five years. About 88 per cent. of the copper is thus extractable. The liquors are filtered through copper sulphide ores, to reduce ferric salts, and then precipitated by scrap iron. This process is only suited for working immense uniform deposits, at places where capital commands a low rate of interest. J. W. RICHARDS.

A Proposed Process for Extracting Copper from Low-Grade Ores. BY G. D. VAN ARSDALE. *Eng. Min. J.*, June 6, 1903.—The writer discovered that sulphur dioxide, under proper conditions, precipitates copper from cupric sulphate solutions, also producing free sulphuric acid. The reaction is probably

$$CuSO_4 + SO_2 + 2H_2O = Cu + 2H_2SO_4.$$

At atmospheric pressure, in the cold, the solution would only precipitate a small amount of cupro-cupric sulphite, $Cu_2SO_3.CuSO_3$, but by heating to boiling and passing the sulphur dioxide through, a large amount of copper is precipitated. If the vessel is closed and heated under pressure, 40 or 50 per cent. more copper is precipitated, and the reaction proceeds quantitatively as above. The operation is performed at 100° C., in a lead-lined, steel tank, at 30 pounds pressure per square inch. The extraction process proposed is to take the liquor from which the copper is nearly all precipitated, and use it again for leaching low-grade ores, either silicates, oxides or roasted sulphides. When the solution becomes very impure with iron, it may be purified by Hofmann's process (heating and injection of air). The leaching is done with hot liquor, and therefore proceeds rapidly. The sulphur dioxide is obtained by roasting the sulphide ores. Tests have so far been made only on a laboratory scale. J. W. RICHARDS.

Relative Elimination of Impurities in Bessemerizing Copper Matte. BY W. R. VAN LIEW. *Eng. Min. J.*, June 27, 1903 (read before Am. Inst. Mining Engineers).—The converter selected for the test was making its second charge. The copper was 50 per cent. at starting, went up slowly to 51 per cent. at ten minutes, and then rose regularly to 99.12 per cent. at twenty minutes, averaging 1 per cent. rise every 0.7 minute. Iron was 23 per cent. at starting, remained almost constant for ten minutes, then decreased fast and regularly to 2 per cent. at forty minutes, then slowly to the end. Sulphur was 21 per cent. at starting, decreased slowly and regularly to 19 per cent. at thirty minutes, then fast and regularly to 0 at seventy minutes. Zinc was 1.19 per cent. at starting, increased to 1.20 at ten minutes, fell suddenly to 0.84 at twenty minutes, then decreased regularly to 0.1 at seventy minutes. Antimony was 0.14 per cent. at starting, remained practically constant for forty minutes, then decreased regularly to nearly zero. Arsenic behaved similarly to antimony. Conclusions are that up to the skimming-point it is the oxidation of the iron and formation of ferrous silicate which supplies most

of the heat; from 76.4 per cent. copper to the end it is chiefly the burning of the sulphur which furnishes the heat. Arsenic and antimony are not affected as long as iron is being slagged in large quantity. J. W. RICHARDS.

Methods and Values on the Yukon. BY J. D. MCGILLIVRAY. *Eng. Min. J.*, June 13, 1903.—The richer gravels have been worked out; but, on account of better methods and reduced costs of working, the annual output remains steady and will probably increase. Steam is used for thawing ground, instead of wood fires. Worked-out claims are being reworked by dredging, or steam shovels; one worked-out claim, bought for $75,000, yielded over $1,000,000 by dredging. Hydraulicking is being introduced at a few places, where capital has come in to supply the water. Most of the bench gravels yield over $1 per cubic yard, and some average $6. J. W. RICHARDS.

The Edison Dry Process for the Separation of Gold from Gravel. BY C. M. CHAPMAN. *Eng. Min. J.*, May 9, 1903.—The device was originally made to work the dry places on the Ortiz Mine grant, 35 miles southwest of Santa Fe. The conditions were: (1) The gravel must be excavated, concentrated, and the tailings disposed of for less than 15 cents per cubic yard. (2) The machine must have large capacity. (3) It must save a high percentage of the gold. (4) It must save all sizes of grains of gold. After three years' work, it is found that the separation can be done by letting the gravel fall freely through a horizontal current of air, if the blast is free from puffs and has a perfectly uniform velocity throughout its section, and the material is fed at a uniformly low velocity and not of varying size. The gravel was screened to one-eighth inch, all over being rejected and then divided into five sizes, each of which was separately treated. The gravel carried from 3 to 35 cents worth of gold per cubic yard, and the general average over all showed 92.5 per cent. extraction; the saving was best with the coarser size and poorest with the finest. The concentrates are further treated by an Edison magnetic separator, which removes the magnetite sand, which is in demand as a flux in copper smelting.

J. W. RICHARDS.

Zinc Mining in the Missouri-Kansas District. BY F. EBERLE. *Iron and Mach. World*, May 16, 1903.—The price of zinc was steady in 1902, and the net profits on the money invested in this district were larger than in any previous year. Nearly $10,000,000 worth of zinc ore was produced there in 1902. The mines are shallow, 200 feet deep mines are rare and 300 feet has not yet been mined; yet drilling tests show still richer ore bodies at 400 and 500 feet. J. W. RICHARDS.

Melting Nickel in the Cupola. BY A. K. BECKWITH. *Eng. Min. J.*, June 27, 1903 (read before the American Foundrymen's Association).—Records the practicability of melting down scrap nickel anodes in a cupola, instead of in crucibles. Using a bed of 200 pounds of coke, 200 pounds of nickel scrap were placed on it; then 120 pounds of coke were charged with 300 pounds of nickel, making a total of 320 pounds of coke to 500 pounds of nickel melted at a heat. J. W. RICHARDS.

Nickel Cathodes. BY D. H. BROWNE. *Electrochemical Industry*, June, 1903.—Much time and labor have been spent in attempting to prepare electrolytically soft, flexible, thin sheets for starting nickel cathodes. A rolled nickel cathode is yet preferable to the deposited sheet. The difficulty in plating thick nickel sheets is its tendency to curl up like shavings; this is probably due to the surface toward the anode being deposited under tension, and finally drawing the deposit away from the cathode. Circulation, by replacing the solution at the cathode as soon as its nickel is deposited, helps to correct this condition, also the use of salts of higher solubility and greater mobility; heating makes diffusion more rapid and reduces the viscosity of the solution, and therefore assists. A steady current density, without great variations, is also a desideratum. Finally, the entire art of producing solid nickel deposits of almost any desired thickness assists in maintaining initially good conditions to the end. With a highly-graphitized copper or tinned-iron cathode, a solution of neutral nickel sulphate or nickel ammonium sulphate, kept at about 50° C., a pure nickel anode, clear solution and an efficient system of circulation, a deposit started at any density from 50 to 300 amperes per square meter and kept constant, will produce smooth sheets which will strip easily and lie flat. Such a sheet is glass hard, very springy, and will not bend unless annealed. The tinned-iron cathode is prepared by painting an inch border of P. & B. paint around the edges, then discoloring the surface by a very thin coating of the same paint dissolved in carbon bisulphide or any other thinner; on top of this, fine graphite is rubbed except at the edges of the painted border, where a little adhesion is necessary to keep the deposit on the plate. Cathodes made in this way with 60 amperes current density curl up about two inches; at 200 amperes, they curl into a roll. To get perfectly flat-stripping sheets, the cathodes are curved backwards just the amount which the sheets would curl forwards, with the current density which is used. On stripping from these curved cathodes, the sheets spring to a perfectly plane surface, and need only to be annealed to be ready for use. J. W. RICHARDS.

Anodes for Electroplating. BY C. F. BURGESS AND C. HAMBUECHEN. *Electrochemical Industry*, June, 1903.—One of the chief difficulties in electroplating is at the anode, in order to get

as much metal going into solution in a given time as is taken out at the cathode, and also to produce the minimum amount of anode scrap. The lower the current densitv, *i. e.*, the larger the anode for a given current, the more perfectly does it regenerate the solution; this is especially true of nickel, where the current density must be kept below 5 amperes per square foot to ensure a high efficiency of corrosion of commercial metal. The shape of the anode has much to do with its active corroding surface. Tests were made with a rectangular anode and an oval anode with thin edges, and diagrams are given of the relative current density at different parts of their surface, the plates being at six inches from the cathode and one inch from the side of the tank. While very little current "turned the corners" of the rectangular plate, quite a uniform distribution of current, not quite as large as in front, was found on the back of the oval plate. As they wear away, the rectangular anode will reduce to a very thin rod or strip, which will soon become full of holes or fall apart, while the oval anode will retain its original shape while continually getting smaller. The scrap from the two forms would be about 15 and 5 per cent., respectively, but slightly more weight of oval anodes would be required for a given active surface, because of their shape. J. W. RICHARDS.

The Malay Tin Deposits. BY R. A. F. PENROSE, JR. *Eng. Min. J.*, June 20, 1903.—A well-written, finely illustrated description of the occurrence and mining of tin ore in the Malay Peninsula. J. W. RICHARDS.

The Sain Alto Tin Deposits. BY J. N. NEVINS. *Eng. Min. J.*, June 20, 1903. These deposits are in the mountains south of Sombrerete and west of Sain Alto, in the State of Zacatecas, Mexico. The mountains are of rhyolite, of cretaceous age. Small chambers in the rifts of the rhyolite contain the tin ore, very irregularly distributed and adulterated with iron and manganese oxides. Some of the ore is concentrated in the ravines, being then picked by hand from crevices in the rocks. At Rancho de las Cuevas, near Sain Alto, the ore is smelted with charcoal in tiny furnaces four feet high and ten by five inches in section, lined with refractory clay. Two tuyeres enter about 8 inches from the ground, blast being supplied by circular rawhide bellows worked by hand. The ore often carries 50 to 75 per cent. of tin, but 40 per cent. is the average. The ore is weighed in *arrobas* of twenty-five pounds each, and graded as 6, 8 or 10 arroba ore according as 6, 8, or 10 arrobas are necessary to produce 100 pounds of tin. The total production from this region does not exceed one ton yearly. J. W. RICHARDS.

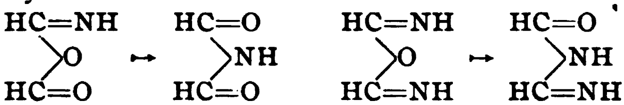
The Recent Discovery of Tin at York, in Alaska. BY W. M. COURTIS. *Eng. Min. J.*, June 27, 1903.—The cassiterite

does not carry gold; one sample of vein ore carried 49 per cent. tin, 3.70 per cent. iron and 3.50 per cent. copper. Recent government reports confirm the presence of tin on the York Peninsula, in some places in large quantity. Several companies have started for that region this year. J. W. RICHARDS.

A Note on Siloxicon. BY E. G. ACHESON. *Eng. Min. J.*, June 27, 1903.—This new electric-furnace product, of the composition Si_2C_2O, is not inoxidizable, as first stated, but decomposes slowly in free oxygen to SiO_2 and CO_2. If the material is in the form of a molded article, the change causes a light green, vitreous glaze. In a reducing atmosphere or in absence of free oxygen, no change occurs until, at 2800° C., it gives off Si and CO and leaves SiC, or carborundum. J. W. RICHARDS.

ORGANIC CHEMISTRY.

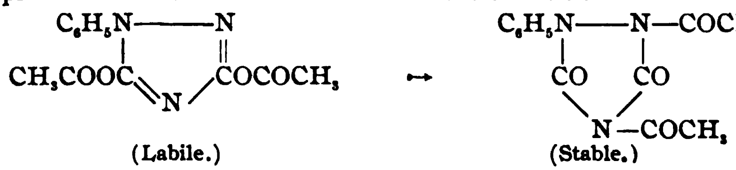
On the Molecular Rearrangement of Imidoacid Anhydrides. BY HENRY L. WHEELER AND TREAT B. JOHNSON. *Am. Chem. J.*, 30, 24–39.—Types I and II would be expected to undergo molecular rearrangement to diacylamides and acylamidines, respectively:



(I) (II)

and such rearrangements were observed in a number of cases. *Benzanilidimide chloride and silver acetate*, in cold dry ether, yielded only acetbenzanilide, the intermediate imido anhydride, $C_6H_5C(OCOCH_3):NC_6H_5$, having suffered rearrangement in the cold. When *silver p-brombenzoate* was used instead of the acetate, a similar metastatic change occurred in the cold, the product being *p-brombenzoyl benzanilide*, $C_6H_5CON(C_6H_5)COC_6H_4Br$, which crystallized from alcohol in colorless needles or prisms, m. p. 150°. The latter substance was also obtained by the interaction of *p*-brombenzanilidimide chloride and silver benzoate. *p-Brombenzanilidimide chloride*, $BrC_6H_4C(Cl):NC_6H_5$, was prepared from *p*-brombenzanilide and phosphorus pentachloride. It forms long needles, m. p. 78°, which revert to the anilide when crystallized from ligroin. It distils mostly at 205°–207° at 12 mm. pressure. *Ethylanilidochlorformate*, $C_6H_5N:C(Cl)OC_2H_5$, *with silver benzoate* and *phenylbenzimidoethylester with chlorcarbonic ester* both gave phenylbenzoylurethane, $C_6H_5N(COC_6H_5)CO_2C_2H_5$, m. p. 67°–68°. From *benzanilidimide chloride and silver anisate*, three products were isolated—anisic anhydride, benzoylanisanilide, and benzoylbenzenyldiphenylamidine. The production of this amidine and anisic anhydride involves the previous formation of phenylimidobenzoicanisic anhydride, $C_6H_5N:(C_6H_5)$

C.OCO.$C_6H_4OCH_3$. *Benzoylanisanilide* was also prepared from phenylimidoethylbenzoate and anisylchloride. It crystallizes from alcohol in six-sided tables, m. p. 162°–163°. *Benzoylbenzenyldiphenylamidine*, also obtained from the amidine and benzoylchloride, separates from alcohol in lozenge-shaped crystals, m. p. 171°. *Anisanilidimide chloride*, $CH_3OC_6H_4C(Cl):N.C_6H_5$, crystallizes from petroleum ether in colorless prisms, m. p. 70°, and distils at 220°–230° at 17 mm. pressure with almost total decomposition. *Benzanilidimidechloride and silver m-nitrobenzoate* gave *m-nitrobenzoylbenzanilide*, colorless prisms (from alcohol), m. p. 139°. In general, the behavior of the sodium and silver salts of amides and anilides with acid anhydrides and acyl chlorides may be satisfactorily explained as follows: Salts of the type $C_6H_5C(NH)OAg$ give nitrile and acid with acyl chlorides, while the N-substituted salts $HC(NC_6H_5)OAg$ give diacylanilides, in both cases imidoacyl anhydrides being formed as the first step in the reaction. Instead of the chloride acting by addition, as previously supposed, the acyl group directly replaces the metal. The products in the former case decompose at ordinary temperatures, while those in the latter rearrange into N-derivatives. The action is similar to that of alkyl halides, but the imidoacid anhydrides suffer molecular rearrangement far more readily than the imidoesters. From work done by Mr. Geo. S. Jamieson, it appears most probable that the "imidoxanthides" of Tschugaeff, from benzanilidimide chloride and xanthogenates, are really dithiodiacylanilides, RCS.N(C_6H_5)CSOR, and not imidoanhydrides at all. *Labile diacetylphenylurazole.* When the silver salt of phenylurazole was treated with acetyl chloride in cold benzene solution, the labile diacetyl phenylurazole was obtained instead of the monacetyl derivative reported by Acree. This labile derivative forms colorless prisms, melts at 113°–115° when rapidly heated, resolidifies at about 120°, and then does not melt again until about 162°, whereby it changes to the stable form. Boiled with water, this labile form changes to phenylurazole. The most probable formulas for the labile and stable forms are



(Labile.) (Stable.)

The labile form is, therefore, an imidoacid anhydride, which changes to an amide derivative on heating, as in the preceding cases. *Stable diacetylphenylurazole* melts at 162°, and is identical with the diacetyl derivative of Thiele obtained from the urazole and acetic anhydride. Boiled with water, it changes to the monacetyl derivative. *1-Phenyl-3,5-diethylurazole*, together with regenerated phenylurazole, were the products obtained from the

silver salt of the latter and ethyl iodide. The diethyl derivative crystallizes from ligroin in colorless needles, m. p. 46°–47°, and is insoluble in alkali. The monethyl derivative reported by Acree as the result of this reaction was possibly a mixture of equal parts phenylurazole and its diethyl derivative. The *silver salt of phenylurazole* gives analytical results corresponding to a *mono*-silver salt, although it yields *di*acetyl and *di*ethyl derivatives. The results of the work, so far, indicate that when an acyl derivative, stable on heating, is obtained from a compound of the structure —CONH— or —C(OH)=N—, the acyl radical is attached to N. M. T. Bogert.

On Certain Nitro Derivatives of the Vicinal Tribrombenzol. By C. Loring Jackson and A. H. Fiske. *Am. Chem. J.*, 30, 53–80.—*3,4,5-Tribromnitrobenzene* is easily prepared by treating *p*-nitraniline with bromine and then replacing with bromine the amine group in the dibromnitraniline thus obtained. By the action of a dilute solution of sodium methylate it is converted into *2,6-dibrom-4-nitranisol*, while a much stronger solution of the methylate yields *4-methoxy-3,5-dibromazoxybenzene*, crystallizing from benzene in yellowish white needles, m. p. 214°. The latter substance was also obtained by the action of sodium methylate upon the dibromnitranisol. Reduction of dibromnitranisol with tin and hydrochloric acid gives the corresponding *dibromanisidine*, white crystals, m. p. 64°–65°. In similar manner, a dilute solution of sodium ethylate changes the tribromnitrobenzene to *2,6-dibrom-4-nitrophenetol*, while a strong solution gives the azoxy body. The phenetol crystallizes from alcohol in white needles, melting at 58°–59°, and not at 108° as reported by Staedel. *4-Ethoxy-3,5-dibromazoxybenzene* can also be prepared from the dibromnitrophenetol and sodium ethylate. It crystallizes from benzene in yellowish white needles, m. p. 163°. *2,6-Dibrom-4-aminophenetol* crystallizes from alcohol in broad, white plates, melting at 107°, and not at 67° as stated by Staedel. 3,4,5-Tribromnitrobenzene is changed to *2,6-dibrom-4-nitrophenol* when boiled with caustic soda, while boiling with a mixture of fuming nitric and strong sulphuric acids converts it to the 1,2-dinitro body, which is much more reactive than the mono-nitro compound. *3,4,5-Tribrom-1,2-dinitrobenzene* forms large yellowish white prisms, m. p. 160°. With sodium methylate in the cold, it gives tribromnitranisol, while at higher temperatures the product is dibromnitro-dimethoxybenzene. *2,3,4-Tribrom-6-nitranisol* crystallizes from alcohol in white needles, m. p. 109°–110°. *Dibromnitrodimethoxybenzene (2,4-dibrom-6-nitroresorcinol dimethyl ether)* is also formed by boiling the tribromnitranisol with sodium methylate. It crystallizes from alcohol in white needles, m. p. 81°. *2,3,4-Tribrom-6-nitrophenetol* crystallizes from alcohol in white rosettes which gradually darken on standing, m. p. 74°. *2,3,4-Tribrom-6-nitrophenol*, prepared by boiling the tribromdinitro

body with ten per cent. caustic soda, crystallizes from benzene in yellow prisms, m. p. 120°–121°. Its *sodium salt* forms bright crimson crystals more soluble in alcohol than in water. The *silver salt* separates from boiling water in small red needles, and yields the corresponding anisol when heated in a sealed tube with methyl iodide. Sodiomalonicester and tribromdinitrobenzene gave a *substance*, melting at 103°–104°, apparently $C_6HBr_3(NO_2)_2CH(COOC_2H_5)_2$. *2,3,4-Tribrom-6-nitraniline*, from tribromdinitrobenzene and cold alcoholic ammonia, crystallizes from benzene in bright yellow needles, m. p., 161°. The same reaction carried out at 100° yields *2,4-dibrom-6-nitro-m-phenylenediamine*, which crystallizes from alcohol in bright yellow needles, m. p. 189°–190°. *2,3,4-Tribrom-6-nitrodiphenylamine*, from tribromdinitrobenzene and aniline, crystallizes from alcohol at first in a mixture of red prisms and yellow needles, the latter changing on recrystallization to the red prisms. It melts at 138°–139°. Reduction of tribromdinitrobenzene gives *3,4,5-tribrom-o-phenylene diamine*, m. p. 91°, which forms a chloride with one molecule of HCl. *Diphenylene-3,4,5-tribromquinoxaline*, $C_6HBr_3N_2C_2C_{12}H_8$, from the *o*-diamine and phenanthrenequinone, forms a yellow, insoluble solid not melting at 250°. *Diphenyl-3,4,5-tribromquinoxaline*, $C_6HBr_3N_2C_2(C_6H_5)_2$, from the *o*-diamine and benzil, forms a light brick-red powder. The results of the above experiments indicate that in tribromdinitrobenzene a nitro group is replaced more easily than an atom of bromine. M. T. BOGERT.

BIOLOGICAL CHEMISTRY.

The Reaction of Certain Water Bacteria with Dysentery Immune-Serum. BY D. H. BERGEY. *J. Med. Research*, 10 (New Series, 5), 21–31.—The agglutination reaction with dysentery immune-serum cannot be relied upon in the differentiation of organisms of the *Bacillus dysenteriae* group unless the limits of the agglutinating power of the serum employed for the particular organism against which the animal has been immunized are known. The normal serum of the horse, rabbit and dog contains agglutinins in relatively small amounts for a variety of organisms. The immunization of an animal against a particular organism increases not only the agglutinin for that organism, but likewise induces an augmentation of the agglutinins of other organisms which are closely related in their receptor apparatus. Absorption experiments show that the absorption of the agglutinins from a serum, by means of a particular organism, not only removes the agglutinins for the organism employed in the absorption experiment, but also some of the agglutinins for closely related organisms. In the absorption experiments upon the dysentery immune-sera, the water bacteria show a more marked influence upon the agglutinins of *Bacillus dysenteriae* (New Haven for in-

stance), in the serum of an animal immunized against this organism than do the organisms of the Philippine group or those isolated from cases of summer diarrhea. Comparative studies of the biologic characters of the water bacteria show that none of them are true dysentery bacilli. They are similar to the organisms designated pseudo-dysentery bacilli by Lentz and Kruse, and are probably *Bacillus coli communis* and *Bacillus faecalis alkaligenes* respectively. F. P. UNDERHILL.

The Connection between the Alkalinity of Certain Bacterial Filtrates and Their Hemolytic Power. BY EDWIN O. JORDAN. *J. Med. Research*, 10 (New Series, 5), 31–42.—In many particulars the conditions that influence the alkalinity of the fluids containing the thermo-stabile bacterial hemolysins affect also the hemolytic properties of these fluids The amount of hemolysin exists, rises and falls in a heated filtrate in such exact correspondence with the alkalinity that it is impossible to avoid the conviction that the "hemolysin" and the active hydroxyl ion are one and the same. F. P. UNDERHILL.

Mucin as a Bacterial Product. BY LEO F. RETTGER. *J. Med. Research*, 10 (New Series, 5), 101–109.—Mucin was isolated from the peptone and bouillon cultures of the following organisms: *Vibrio Finkler-Prior*, *Müller's spirillum*, *B. mucosus capsulatus*, *B. pyocyamus* (two varieties), *B. fluorescens*, *B. coli communis*, *B. subtilis*, *B. megatherium*, *Proteus vulgaris*, *Micrococcus ureae*, *Sarcina lutea*, and *Staphylococcus pyogenes aureus* and *citreus*. F. P. UNDERHILL.

The Relations of Specific Gravity and Osmotic Pressure to Hemolysis. BY CLARENCE QUINAN. *J. Med. Research*, 10 (New Series, 5), 1–11.—The results of this investigation may be summarized as follows: If a goat be given occasional large doses of defibrinated rabbit's blood, its serum suffers a progressive loss of specific gravity. The molecular concentration of the serum, as expressed by the depression of the freezing-point, is correspondingly increased. There is no constant relation between the specific gravity of active serum and the rate of globulysis. After a definite degree of depression, the specific gravity becomes constant, and a certain value is peculiar to each animal.

F. P. UNDERHILL.

Observations on the Coagulation Time of the Blood and the Blood Plates. BY JOSEPH H. PRATT. *J. Med. Research*, 10 (New Series, 5), 129–127.—The blood plates always disappear as soon as coagulation begins. In defibrinated blood only an occasional plate is seen. Injection of albumose into the circulation of a dog causes the disappearance of the plates. Histone behaves in a similar manner. There is no direct relation between the time of coagulation and the number of blood plates.

F. P. UNDERHILL.

A Study of the Proteolytic Enzymes and of the So-Called Hemolysins of Some of the Common Saprophytic Bacteria. BY A. C. ABBOTT AND N. GILDERSLEEVE. *J. Med. Research*, 10 (New Series, 5), 42–63.—The destiny of non-toxic, though otherwise physiologically characteristic products of bacterial life in the body, is determined by the presence of specific neutralizing substances that can be demonstrated in the circulating blood. By the customary methods of artificial immunization, the amount of such antidotal substances in the blood may be increased, but only to a slight degree. Through the use of sera from animals immunized from the non-toxic bacterial products, poor though such sera are in specific immune body, it is possible to distinguish the proteolytic enzymes resulting from the growth of different bacterial species from one another, as well as from certain physiologically analogous enzymes of animal origin. The proteolytic enzymes elaborated by certain bacteria in the course of their growth are much more resistant to high temperatures than is generally supposed, some being capable of exhibiting their characteristic function after exposure in the moist state to a temperature of 100°C., for from fifteen to thirty minutes. The so-called hemolysins of bacterial origin are probably proteolytic enzymes.

F. P. UNDERHILL.

A New Method of Hemo-Alkalimetry and a New Hemo-Alkalimeter. BY ARTHUR DARE. *Bull. Johns Hopkins Hospital*, 14, 175–180.—A description of a new method of hemo-alkalimetry and a new hemo-alkalimeter together with the results of some experiments. F. P. UNDERHILL.

Some Comparative Examinations of Breast Milk and Cow's Milk and the Effect of the Addition of Alkalies and Other Antacids to Cow's Milk. BY CHARLES G. KERLEY, A. H. GIESCHEN, AND GEORGE T. MYERS. *N. Y. Med. Record*, 64, 201–205.—The results of this research show that breast milk and cow's milk are both acid. The litmus paper test for milk is unreliable because of the variation in the quantity of litmus paper and the litmus taking part in the reaction and not acting as an indicator. The effect of adding lime water or bicarbonate of sodium to feedings is to retard or inhibit the formation of curds by rennet. The teaching that lime water, bicarbonate of sodium, or carbonate of potassium, should be added to fresh milk or feedings simply because they are antacids is erroneous. The addition to milk or feedings of alkalies or salts that become alkaline in solution is an empirical method of aiding digestion by preventing the formation of dense curds that would slowly leave the stomach and be difficult of digestion in the intestine.

F. P. UNDERHILL.

The Effect of Diuretics, Nephritic Poisons, and Other Agencies on the Chlorides of the Urine. BY TORALD SOLLMANN. *Am. J. Physiol.*, 9, 425–454.—See this Journal, 26, R.

F. P. UNDERHILL.

The Comparative Diuretic Effect of Saline Solutions. By TORALD SOLLMANN. *Am. J. Physiol.*, 9, 454–466.—See this Journal, 25, R, 78. F. P. UNDERHILL.

The Response of the Frog to Light. By ELLEN TORELLE. *Am. J. Physiol.*, 9, 466–489.—At the usual temperature of the laboratory *Rana veriscens virescens* or *R. clamata* are positively phototactic. They respond differently to different intensities of light. A rise in the temperature to 30° C. accelerates the rate of positive response. A lowering of the temperature to 10° C. produces movements away from the light. When placed in water, the temperature of which is lowered to 10° C., the frogs swim downward. The frogs turn away from red light and move toward blue light. They move toward green and toward yellow light, but are not definitely oriented by either. F. P. UNDERHILL.

Nuclein Metabolism in Lymphatic Leukaemia. By YANDELL HENDERSON AND GASTON H. EDWARDS. *Am. J. Physiol.*, 9, 417–424.—A study of the urine, faeces, and number of leucocytes in a case of lymphatic leukaemia in which the patient was fed upon a relatively fixed diet with the addition of nucleic acid, and other substances such as arsenic, bone-marrow, etc. The results show that the total acidity of the urine was closely parallel to the nitrogen, which accords with the view that the total acidity is chiefly an expression of the sulphuric acid resulting from the proteid metabolism. The chlorides varied more than any other excretion, and showed no relation to nitrogen or acidity. The uric acid and phosphates were closely parallel and their variations when studied in connection with the curves for the number of circulating leucocytes and excretion of chlorides are very suggestive. They seem to show that there occurred a marked increase in nuclear break-down, followed by a return to the usual rate; an increase in the number of circulating leucocytes followed by a diminution in their number; and coincident with these changes, or slightly preceding them, a considerable increase in the excretion of chlorides followed by an immense diminution.

F. P. UNDERHILL.

Salivary Digestion in the Stomach. By W. B. CANNON AND H. F. DAY. *Am. J. Physiol.*, 9, 396–417.—The cat was the animal employed in this investigation. The evidence that the action of ptyalin is inhibited in the stomach soon after the ingestion of food is inconclusive. The support for this belief from the commonly accepted accounts of mixing currents in the stomach is not well founded. Observations show that in many animals, including man, gastric peristalysis occurs only in the pyloric end of the stomach; the cardiac end remains undisturbed by the waves. Food in the pyloric end is soon mixed with the gastric secretions, but food in the cardiac end of the stomach is not mixed with the gastric juices for two hours or more, and in this region, there-

fore, during that time, salivary digestion may go on undisturbed. Mixing proteid with carbohydrate food protects the ptyalin from the action of free hydrochloric acid in the relatively small pyloric part of the stomach and on the surface of the cardiac contents. The greater mass of the food, lying in the fundus, undergoes uninterrupted amylolysis, not because the proteid protects the ptyalin, but because the food in this region is not mixed with the gastric juice. Much of the starch not changed to sugar is changed to dextrin, and thus, since dextrin is not readily fermentable, the food is saved to the organism. In the early stages of gastric digestion, if the food has been properly masticated, the fundus serves chiefly for the action of the ptyalin; the pyloric portion, after a brief stage of salivary digestion, is, therefore, the seat of strictly peptic changes. Later, after two hours or more, as the contents of the fundus become acid, the food in the stomach as a whole is subjected to the action of proteolytic fermentation. F. P. UNDERHILL.

On the Question of Proteid Synthesis in the Animal Body. BY YANDELL HENDERSON AND ARTHUR L. DEAN. *Am. J. Physiol.*, 9, 386–391.—Products, obtained from the digestion of meat, and no longer giving the biuret reaction, were fed to a starving animal (dog) in order to see whether the animal organism could synthetize tissue proteids from the cleavage products. The conclusions reached are that the nitrogenous substances in the diet were not immediately and wholly converted into urea and excreted, but that they were, on the contrary, to a considerable extent retained, and that that portion which was expended (appearing in the urine) exerted a marked proteid-sparing action. The diminution in the nitrogen excretion from 1.9 grams in the fore period to 0.8 gram in the after period of fasting suggests that the protoplasmic waste had not been made good, and that the retention of nitrogen is not in itself a proof of proteid synthesis. F. P. UNDERHILL.

Observations on the Urine of the Muskrat (Fiber Zibethicus). BY ROBERT BANKS GIBSON. *Am. J. Physiol.*, 9, 391–396.—This article deals with the quantitative and qualitative composition of the urine of the muskrat, the animal being fed upon a mixed diet. With the exception of creatinine all the constituents of human urine were present in greater or less quantity. Feeding the animal upon tissues rich in nucleic acid did not give rise to an excretion of allantoin as is true in the case of the dog and cat. F. P. UNDERHILL.

New Experiments on the Physiological Action of the Proteoses. BY FRANK P. UNDERHILL. *Am. J. Physiol.*, 9, 345–374.—The experimental work presented in this paper shows that there is no occasion for attributing the physiological effects fol-

lowing the injection of proteoses into the circulation to the presence of contaminating substances derived from animal tissue or elsewhere. This conclusion is in direct opposition to that of Pick and Spiro (*Ztschr. physiol. Chem.*, 1900–'01, 31, 237) whose work tended to show that the proteoses themselves were inert, and that whatever effects followed their introduction into the circulation were due to a contaminating substance, called by them "peptozyme." Methods of treatment, whereby the toxic action of the proteoses was eliminated, were also devised by those authors. The present article shows that these methods of purification are of little value. The methods employed by Pick and Spiro to obtain proteoses were found to be of little service since they failed under the conditions employed by Pick and Spiro in giving the author sufficient proteoses to call forth the reactions characteristic of these bodies. These methods, modified, yielded products in every way as toxic as the proteoses of other origin. Experiments were made with products obtained under conditions in which any contaminating substance would be eliminated, thus showing that the proteoses in themselves are the toxic bodies. Products injected were proteoses formed from edestin of hemp seed with acids, by the action of bromelin and papaïn and by the action of superheated water in the autoclave; proteoses formed from excelsin of the Brazil nut by the action of acids; proteoses formed from casein and acid, and native proteoses obtained from hemp seed and the Brazil nut. F. P. UNDERHILL.

On Rigor Mortis. BY OTTO FOLIN. *Am. J. Physiol.*, 9, 374–380.—This article is a preliminary communication tending to show that the coagulation theory of rigor mortis is incorrect.
F. P. UNDERHILL.

On the Formation of Dextrose in Metabolism from the End-Products of a Pancreatic Digestion of Meat. BY PERCY G. STILES AND GRAHAM LUSK. *Am. J. Physiol.*, 9, 380–386.—Five grams of nitrogen in the form of the products of pancreatic digestion of meat fed to phlorhizinized animals may give rise to the formation of about 12 grams of dextrose, or D : N : : 2.4 : 1. The same amount of nitrogen fed as native proteid would be expected to produce 18 to 19 grams of sugar. No light is thrown upon the question whether the sugar in these experiments was formed after a proteid synthesis had occurred or more directly from the amido acids. F. P. UNDERHILL.

INDUSTRIAL CHEMISTRY.

The Petroleum Industry of Canada. BY W. J. K. VANSTON. *J. Soc. Chem. Ind.*, 1903, page 393.—In 1897, Canada stood sixth in the list of petroleum-producing countries, furnishing 0.64 per cent. of the total production of the world. Prac-

tically all the Canadian oil is found in Ontario, in the counties of Kent and Lambton. The Lambton field is situated on the Cincinnati, anti-clinal which stretches through the United States and Canada. The oil is found in the corniferous limestone at a depth of from 460 to 480 feet in the Petrolia field and at about 370-400 feet in the Oil Springs area. The Canadian oil yields only about 40 per cent. of a rather inferior illuminating oil as compared with 75-78 per cent. in the case of Pennsylvania oil. The wells are slow producers and, because of economies practiced, a well pays that only produces 8-10 gallons a day. The introduction of surface boring, the "jerker line" system, the use of pipe lines and underground receiving tanks and the burning of gas from the wells as fuel are among the developments. In 1900 the number of wells was said to be 10,000, producing 710,498 barrels, or only about 71 barrels per well. Oil land in a tested locality is worth about $300 per acre on the average, about ten times its value for farming purposes. The royalty on leases is generally one-seventh of the oil produced. The average price of crude oil in 1900 was $1.62 per barrel. Since 1898 the entire refining business has been in the hands of the Imperial Oil Go., which is said to be controlled by the Standard Oil Co., of the United States. The main refinery is at Sarnia, where there are sixteen "crude" stills of 600 barrels each and eight tar stills of 250 barrels each, but owing to the growing scarcity of oil it is not worked to its full capacity. S. P. SADTLER.

A New Method of Turpentine Orcharding. BY CHARLES H. HERTZ. *U. S. Dept. of Agriculture, Bureau of Forestry, Bulletin No. 40*, 1903.—The Bulletin consists of 43 pages with numerous half- and whole-page illustrations. The method described consists in brief, in scraping the trees for a certain distance and placing gutters and vessels for catching the crude spirits of turpentine, at the bottom, instead of cutting out a container in the body of the tree itself. The tree sustains less injury and the yield of turpentine is greater. S. P. SADTLER.

New Cottrell Storage Battery. *Western Electrician*, May 2, 1903, page 349.—This cell is 11 inches high, $5^1/_2$ inches wide and $3^1/_2$ inches thick and weighs ten pounds. Seventy cells, weighing 220 pounds, in a space measuring 12x18x24 inches, are said to be sufficient to run an automobile of the "run-about" pattern at the rate of 10 miles an hour for five hours. The plates are of carbonized woven cloth enveloped in thin sheet lead, pierced with circular holes. The fabric is saturated with a solution, the composition of which is not given. S. P. SADTLER.

The Concentration of Sulphuric Acid. BY DR. FRANZ MEYER. *J. Soc. Chem. Ind.*, July 15, 1903, p. 781.—The author describes Dr. A. Zanner's evaporating pans for con-

centrating chamber acids, etc., by utilizing the waste heat from the roasting (pyrites) ovens, the dilute acid being contained in pans made of earthenware plates, situated wholly in the horizontal flues. The pan consists of a shell of cast iron, five-eighths inch thick, and lined with stoneware plates half an inch thick, forming a rectangular box with a plate of stone as a cover. With gases at a temperature of 400°–425° C., one square foot of pan bottom area will produce 400 pounds of 66° Bé. acid in twenty-four hours. If chamber acid alone is concentrated, the product is equal in quality to acid concentrated in platinum pans.

S. P. SADTLER.

Portland Cement Manufactured from Blast-Furnace Slag. BY THE CHEVALIER C. DE SCHWARZ. (Abstract from paper read before the Iron and Steel Institute.) *Engineering News*, 1903, page 469.—The manufacture of cement from granulated slag at the blast-furnaces has advantages, such as the use of waste or very cheap power, waste coke, screenings and rubble, the slag and cheap limestone. The cement is said to be very regular in its composition and shows strength tests (of cement 1 part and sand 3 parts) made by the Municipal Laboratory of Vienna.

(*a*) Seven days { 383 lbs. tensile strength.
3880 lbs. compression strength.

(*b*) Twenty-eight days { 551 lbs. tensile strength.
5411 lbs. compression strength.

The production of blast-furnace cement is most cheaply effected along with the production of gray pig iron and basic slag, which slag needs very little addition of limestone or marl to make a good cement and at the same time it is burned at a comparatively low heat or merely mixed with slaked lime. The cement after setting is extremely hard, as tested with the emery wheel and acts very well with salt-water.

S. P. SADTLER.

A New Material for Pipe-Joints. *American Gas Light Journal*, June 1, 1903.—The material is called "Leadite" and consists of sulphur, brick-dust, and sand, and also (it is said) of various other materials. It is used in place of lead for making cast-iron pipe-joints and is cast into place the same as lead.

S. P. SADTLER.

Transmission of Power by Gas. *American Gas Light Journal*, May 25, 1903.—In the article the proposition is to conduct gas for long distances under high pressure instead of the electric current; to have sub-stations where the pressure is reduced for heating and lighting, and gas engines and generators for the use of electricity. The main advantage claimed seems to be that it would be a very convenient form of distribution and would be a more economical source of power with cheap gas and 1000 H. P. (and larger) gas-engines than expensive illuminating gas and

smaller engines than are now used. The cost with English Mond gas at 150 B. T. U. per cubic foot would be the same as coal-slack at $9 per ton. The leakage claimed would be about one-tenth per cent. per mile. S. P. SADTLER.

Apparatus for, and Methods of, Treating Wood to Protect It from Fire and Preserve It from Decay. BY JOSEPH L. FERRELL. *Proceedings of the Engineers' Club of Philadelphia*, April, 1903.—In all processes hitherto described for the impregnation of wood with chemicals, the effort has been made to liquefy and remove by vacual extraction the real sap, or soul, of the wood. The wood is weakened and the results in cases, both of preservation from decay and resistance from fire, were of doubtful value. With regard to appliances, the old form of impregnating cylinder, 62 to 84 inches in diameter, with external hinged gate would hardly stand 175 pounds, even with much leaking. The new form of apparatus has an internal sliding gate operated by hydraulic pressure and, as the pressure clamps it tighter, it will stand 1,000 pounds without leaking. In this way the lumber is saturated in a small fraction of the time taken by the old method. In saturating with aluminum sulphate, the wood is not discolored in any way nor injured in strength, and an average of 2,800 samples tested shows a fire resistance of fourteen times that of the "old line" sulphate of ammonia wood. While timber can be saturated with preservative solutions in the cylinder, the difficulty that has been met with is to have it stand the action of the elements, especially in railroad ties. Creosote largely volatilizes and its phenols are washed away. Aqueous solutions, such as copper and zinc salts, are easily dissolved by water and speedily removed. To improve conditions in this respect, a small cylinder is used for ties, and the operation of saturation is conducted so quickly that the whole operation is complete in seven minutes. Twenty saturators, at a cost of $20,000, can be made to saturate 1,500 ties in a day of twelve hours, or 500,000 per annum. The apparatus is constructed in such a way that two solutions, one following the sap canals and entering the same through a rubber ring, at the end of the cylinder to which the tie is pressed, and another forced through the medullary rays of the wood, from the surface, meet and effect double decomposition. This reaction forms a soluble preservative substance and an insoluble inert one to close the ends of channels and effectually shutting in the preservative. Thus calcium chloride and zinc sulphate meet, forming zinc chloride, the preservative, and calcium sulphate, which protects it. These chemicals are cheaper than using zinc chloride alone, for less of the zinc salts is used in this case and it is retained, while the zinc chloride by itself is lost. In addition to an account of the large pressure cylinder for treating wood for fire-proof purposes mainly, and the apparatus for saturating ties by double decomposition,

the article mentions a modification of fire-proofing treatment by surface-coating in such a way that the external fibers or canal interstices are filled with a fire-resisting solution, and additional quantities of such material, forming a transparent or colored enamel, are coated on the wood and firmly adhere to their anchorage between the fibers. In this way the wood of a structure already built can be amply protected. The enamel can also be proof to the action of the elements (when dry) for external use.
S. P. SADTLER.

Manufacture of Cement from Marl and Clay. HENRY S. SPACKMAN. *Proceedings of the Engineers' Club of Philadelphia*, April, 1903.—Marl is of organic origin, the deposits being found in low lands, marshes and bottoms of lakes. It is soft in texture and, ordinarily, 90 per cent. will pass through a 100-mesh sieve. In Northern Ohio, the marl comes from calcareous waters and is not so soft. In general, marl deposits are found in shallow waters and it is fairly clean when the water is over two feet deep. It often contains sand, in addition to organic matter which latter is easily burned off when not mechanically separated, but the sand of more than 3 per cent. is very objectionable even when ground. Analysis of marl for Portland cement should vary between the following limits:

Silica	00.00— 3.00
Alumina and oxide of iron	00.00— 5.00
Lime	45.00—56.00
Magnesia	00.00— 1.50
Sulphuric anhydride	00.00— 1.00
Organic matter	0.00— 5.00

The clay used with marl should be free from uncombined silica. For large mills, the marl is excavated by dredges or steam shovels and often pumped direct from dredge to mill or pumped to scows and then from the scows to the mills. It contains about 50 per cent. of water. Efforts are now being put forth towards drying marl before making into cement. The mechanical operations are as follows: 1. Dredging, if below water, or mining with cars, if on land. 2. Pumping or carrying to mills in cars, the pumping being best done by double cylinders with compressed air. 3. Pugging mill to break it up. 4. Storage tanks. 5. Mixing in mixing tank. 6. Ground wetting in tube mills or sometimes with millstones. 7. Ground "slurry" stored. 8. Run into rotary kilns, direct with 50–60 per cent. water. 9. Clinker sometimes cooled by the blast for burning coal. 10. Ground by ball or tube mills or Griffin mills. All apparatus is run by electric motors. The coal (generally used for fuel) is powdered to 100 mesh. The chief advantages in the use of marl are that the excavation and grinding of the raw materials are less difficult and a more intimate mixture ensues. The disadvantages are: Handling so much water as material; increased fuel consumption

of 50 per cent.; reduction in output; difficulty in operating in cold weather and materials must be kept moving. The author thinks new mills are favoring the manufacture of Portland cement from clay and limestone rather than either argillaceous limestone or marl. S. P. SADTLER.

Some Kansas Petroleum. BY EDWARD BARTOW AND ELMER V. MCCOLLUM. *Trans. Kansas Acad. Sci.*, **18**, 57–58.—Eight samples of oil from different localities in Allen and Neosho counties showed decided variations in physical properties. The specific gravity ranged from 0.866 to 0.940; the flash-point from 11° C. to 143° C.; the burning-point from 25° C. to 72° C. Distillation tests were also made which will be reported on later.
W. F. HILLEBRAND.

Professor F. Haber on Electrochemistry in the United States. *Electrochemical Industry*, June and July, 1903.—A translation and abstract of the extensive report published by Dr. F. Haber in the *Zeitschrift für Elektrochemie*. The doctor's visit lasted sixteen weeks, and his impressions of American industrial and scientific life are very interesting, and well worth reading, either in the original or in this extensive abstract. J. W. RICHARDS.

The McDonald Electrolytic Cell as a Chlorine Producer. BY T. ULKE. *Eng. Min. J.*, June 6, 1903.—A plant of 50 cells is in operation at the Clarion Paper Mill, Johnsonburg, Pa. The cells have no revolving or reciprocating parts; each contains ten carbon anodes in the central compartment of a three-chamber, rectangular, cast-iron tank, the other cathode compartments being separated from it by asbestos diaphragms supported by perforated iron partitions. The diaphragm consists of asbestos paper fastened to asbestos cloth by a little sodium silicate. The chlorine is led by vitrified pipe to absorbing towers, where it comes in contact with milk of lime to form bleaching solution. The output is $10^1/_2$ pounds of chlorine per electrical horse-power day, the voltage per cell $4^1/_2$, amperes 420, and $2^1/_2$ H. P. per cell. It is reported that the Standard Chlorination Works, at Colorado City, will put up 500 of these cells. J. W. RICHARDS.

Egyptianized Clay. BY F. A. J. FITZGERALD. *Eng. Min. J.*, May 9, 1903.—Mr. E. G. Acheson has made experiments to determine the cause of the plasticity of clays, and finally found that by treating clays with dilute solutions of tannic acid the plasticity was greatly increased, and that clays thus treated had a much greater tensile strength when made up into forms and baked, requiring less water in getting into working condition and producing a less porous article. It occurred to Mr. Acheson that possibly the straw used by the Egyptians in making their brick had a similar effect; he, therefore, made an extract from straw and found that it worked similarly to the solution of tannic acid. It

was, therefore, the vegetable extract from the straw which improved the Egyptian bricks, rather than the fibre of the straw. Mr. Acheson has found that a large class of vegetable extracts have a similar effect, and has termed his treatment "Egyptianized Clay."

J. W. Richards.

AGRICULTURAL CHEMISTRY.

Yearbook of the United States Department of Agriculture, 1902. *U. S. Dept. Agr. Yearbook*, 1902, 912 pp.—As in the past, the Yearbook consists of a review of the operations of the Department during the year by the Secretary of Agriculture and miscellaneous semi-popular articles relating to the work of the Department. The usual summary of information of interest to farmers is appended. Of the thirty-seven articles in this Yearbook several are of more or less interest from the standpoint of agricultural chemistry. G. T. Moore discusses the contamination of public water supplies by algæ. While many of the algæ give water a disagreeable odor and taste, their products, so far as known, are not injurious to health. J. K. Haywood describes the examination of water for sanitary, irrigation and other purposes, commenting especially upon the interpretation of analytical data. W. H. Krug reports chemical studies of some forest products of economic importance. Analyses were made of the wood and bark of the western hemlock and of the red, chestnut, white and black oaks. The examination of a number of samples of turpentine oil from different sources revealed in some cases the presence of adulterants, the most common being petroleum in one or more of its fractions. G. T. Moore, in discussing "Bacteria and the Nitrogen Problem," points out the ways in which nitrogen is lost, as by the removal of crops, the waste of sewage, the action of denitrifying organisms, the washing of nitrogen salts from the soil, and the burning of explosives, and describes the source of supply, as nitrate of soda, guano, and the artificial production of nitrates from atmospheric nitrogen. The main part of the article, however, is devoted to an illustrated description of the root tubercle bacteria and the method of artificial inoculation of soils devised by the Bureau of Plant Industry of the Department of Agriculture. Two serious objections have been raised to the use of earth in inoculating soils, namely, the expense and the danger of introducing plant diseases. Pure cultures of the root tubercle bacteria in rich nitrogenous media, introduced in Germany under the name of Nitragin, have on the whole proved unsatisfactory after several years of extensive trial. Cultures of the tubercle bacteria with greatly increased nitrogen-fixing power were obtained by the Bureau by the use of nitrogen-free culture media. In the method devised, the cultures are taken up by some absorbent, allowed to dry, and distributed in this

form. When desired for use, the organisms are revived and allowed to multiply by placing in water containing the proper nutrient salts and may then be introduced into the soil in various ways. In practical field experiments, this method has been found very satisfactory. Facilities are being secured by the Department for preparing the cultures on a large scale. R. D. Milner discusses the cost of food as related to its nutritive value. G. C. Husmann gives an account of grape, raisin, and wine production in the United States and C. M. Daugherty an account of flaxseed production, commerce, and manufacture. The use of fertilizers for special crops is discussed by A. F. Woods and R. E. B. McKenny, and for the peach by M. B. Waite. Of the crops used in the reclamation of alkali lands in Egypt, as described in a paper upon this subject by T. H. Kearney and T. H. Means, barnyard grass, rice, and samar, a reed closely related to the papyrus plant, are especially popular. Sorghum and berseem or Egyptian clover are the only two crops used for this specific purpose in Egypt that are believed to be practically useful in the United States. A thorough trial of the latter is considered very desirable. H. W. LAWSON.

Reclamation of Alkali Lands in Egypt as Adapted to Similar Work in the United States. BY T. H. MEANS. *U. S. Dept. Agr., Bureau of Soils, Bull. No. 21*, 48 pp.—The three methods employed in the reclamation of alkali lands in Egypt are described. These are: (1) Flooding without drainage, which can not be recommended for general use as an efficient method; (2) flooding with open drains, which is effective but wasteful of land; and (3) flooding with tile drains, which in its experimental stage promises to be the most rapid and effective method. In describing the reclamation work in different localities in Egypt, mechanical and chemical analyses are given of a large number of samples of the soils. The use of crops as an aid in reclamation is described more fully in the Yearbook article noted above. It is the belief of the Bureau of Soils that the alkali lands of this country can be reclaimed economically, and suitable drainage with irrigation is recommended for this purpose. As a means of demonstration, work of this kind is being carried on by the Bureau at the present time in several localities in the West. H. W. LAWSON.

Conditions Determining the Poisonous Action of Chlorides. BY H. J. WHEELER AND B. L. HARTWELL. *R. I. Agr. Expt. Sta. Rep.*, 1902, pp. 287–304.—In pot experiments extending through a series of years, the effects of the chlorides of calcium, magnesium, and ammonium upon different crops were studied. The injurious effects of calcium chloride or ammonium chloride, when applied to an acid soil, were found to be prevented or overcome by applications of calcium carbonate, caustic magnesia, or a mixture of basic slag meal, potassium carbonate, and magnesium carbon-

ate. Magnesium chloride was not injurious under conditions where great injury followed applications of the other chlorides tested. On soils corrected for acidity, the use of mixtures containing sulphate of ammonia and potassium chloride is believed to be without danger from the formation of ammonium chloride. In studying the action of chlorides, the determination of the reaction of the soil is essential. H. W. LAWSON.

Investigations Relative to the Use of Nitrogenous Materials. BY. E. B. VOORHEES. *N. J. Agr. Expt. Sta. Rep.*, 1902, pp. 133–180.—Determinations of the losses sustained by barnyard manure when exposed to the leaching action of rain are reported. The extent of the loss was modified by various conditions. In solid manure the loss of nitrogen varied from 25 to 46 per cent., phosphoric acid from 27 to 72 per cent., and potash from 10 to 80 per cent. The nitrogen in fresh manure was, in general, more available than that in leached manure. The relative availability of nitrogen in different fertilizing materials as determined by the amounts recovered in crops was as follows: Nitrate of soda, 100; sulphate of ammonia, 94.8; dried blood, 94.7; fresh solid manure, 36.3; leached solid manure, 36.6; fresh solid and liquid manure, 70.5; leached solid and liquid manure, 48.1 Determinations of the nitrogen content of sandy soils are reported and discussed as regards changes taking place. H. W. LAWSON.

Contribution to the Morphology and the Physiology of Denitrification. BY J. G. LIPMAN. *N. J. Agr. Expt. Sta. Rep.*, 1902, pp. 183–241.—Comparative tests were made of the denitrifying power of a number of organisms, two of which are described as new. In studying the fixation of nitrogen by denitrifying bacteria, it was found that the *Bacillus pyocyaneus* was able to obtain small quantities of nitrogen not contained in the nutrient solutions. "In how far this fixation is a factor in our arable soils yet remains to be determined; but, from the theoretical standpoint, the results reported here are of great interest, in that they show how the same organism may at times exert a destructive effect on combined nitrogen, and at other times it may actually add to the world's store of combined nitrogen." Determinations of the nitrogen content of a number of New Jersey soils and subsoils are reported. H. W. LAWSON.

Field Experiments with Nitrate of Soda on Forage Crops and on Market Garden Crops. BY E. B. VOORHEES. *N. J. Agr. Expt. Sta. Bull. No. 164*, 28 pp.—The experiments reported show profitable results with the use of nitrate of soda as a top-dressing for wheat, rye, and millet applied at the rate of about 150 pounds per acre. The use of 300 to 400 pounds of nitrate of soda per acre, as in previous experiments, gave good results with different vegetable crops. H. W. LAWSON.

The Role of Nitrate and Phosphate Fertilizers in the Richness of Wheat in Gluten. BY L. VIGNON AND F. COUTURIER. *Sci. Amer. Supplement*, **56**, p. 22,995.—In the experiments briefly reported, the gluten in wheat was increased to a limited extent by the use of nitrate fertilizers, the increase not being in proportion to the quantities applied and indicating a low limit for the practical use of nitrates for this purpose. On the other hand, phosphates decreased the percentage of nitrogen in the grain in proportion to the amounts used. H. W. LAWSON.

Losses in Manure. BY W. FREAR. *Pa. Agr. Expt. Sta. Bull. No. 63*, 6 pp.—The loss of nitrogen, potash, and phosphoric acid in manure, allowed to accumulate for about two months under steers in cement-floored stalls, was very much less than that in manure removed daily and stored in a compact heap under a covered shed. The details of this study are given in the report of the station for 1902, page 88. H. W. LAWSON.

The Pentosans. BY J. B. LINDSEY. *Mass. Agr. Expt. Sta. Rep.*, 1902, pp. 69–81.—The literature relating to the determination and digestibility of pentosans is reviewed and the work which has been done at the station along this line is reported. In the different grasses and feeding-stuffs analyzed, the pentosans ranged from 5.18 to 30.35 per cent. The coëfficients of digestibility as determined in experiments with sheep varied from 28.62 to 90.03 per cent. The pentosans in upland hays and most by-products were found to be fully as digestible as the other food constituents, but in swale hay, salt grasses, and wheat bran, the pentosans were rather less digestible owing to the presence of considerable lignified matter. The digested pentosans are believed to be utilized in the animal organism to the same degree as are the other carbohydrates. H. W. LAWSON.

Ash Constituents of Cereals. BY W. P. GAMBLE. *Ont. Agr. Col. and Expt. Farm Rep.*, 1902, pp. 48–51.—The total ash of the grain and straw of barley prepared by Shuttleworth's method was, respectively, 2.19 and 9.70 per cent. The phosphoric acid and potash in the ash of the grain averaged 30.2 and 26.5 per cent. and in the ash of the straw 2.1 and 38.5 per cent., from which it is estimated that a crop of barley yielding 40 bushels per acre would remove approximately 19 pounds of phosphoric acid and 136.5 pounds of potash, a quantity of the latter greatly exceeding former calculations. H. W. LAWSON.

Crystals of Oxalate of Lime in Plants. BY H. W. WILEY. *Science*, **18**, 115–116.—The author reports the presence of calcium oxalate crystals in taro, a staple food plant of the Pacific islanders and describes the remarkable behavior of these crystals in microscopical preparations. The acicular crystals enclosed in dense bundles in oblate spheroidal bodies were projected with

considerable force into the surrounding liquid, the spheroids themselves suffering a corresponding recoil. Many hundreds of the long needles were apparently contained in one of these capsules. The observations tended to show that the burning or prickling sensation attending the mastication of uncooked taro is due to the mechanical action of these crystals. Sap of taro containing no crystals did not produce the burning sensation. The Indian turnip was also found to contain similar capsules enclosing crystals. The juice of this plant, however, contained crystals and produced the characteristic sensation when placed in the mouth. H. W. LAWSON.

Pennsylvania Sugar-Beets in 1901. BY W. FREAR AND W. T. CARTER. *Pa. Agr. Expt. Sta. Rep.*, 1902, pp. 75–87.—The average percentage of sugar in 30 samples of sugar-beets grown in Elk County was 16.01, with a coëfficient of purity of 83.8.
H. W. LAWSON.

Preservation of Cane Syrup. BY W. R. DODSON. *La. Agr. Expt. Sta. Bull. No. 75*, pp. 236–249.—Practical tests were made of sterilizing syrups in small quantities and in bulk. Trials of Spanish moss as a filter for cane juice were unfavorable to the use of this material. The results of experiments indicated that the inversion of sugar in the stalk of the cane is dependent upon the invasion of ferments from without. H. W. LAWSON.

The Enzymes of the Sugar-Cane. BY C. A. BROWNE, JR. *La. Agr. Expt. Sta. Bull. No. 75*, pp. 249–256.—Several enzymes were found in the sugar-cane and its juice, among which a catalase and an oxidase were always present and a peroxidase sometimes present. The presence of enzymes in sugar-cane has a certain practical interest from the fact of their producing a rapid discoloration of the juice after milling. H. W. LAWSON.

Relation of Bacteria to the Inversion of Crystallized Sugars. BY W. R. DODSON. *La. Expt. Sta. Bull. No. 75*, pp. 259–263. —Sterilized sugar inoculated with pure cultures of bacteria isolated from inverting sugar showed a decided inversion, while sugar sterilized but not inoculated did not undergo deterioration. No identification was made of the bacteria isolated and believed to be responsible for the inversion of the sugar under investigation. H. W. LAWSON.

Seventh Report on Food Products. BY A. L. WINTON, ET AL. *Conn. (State) Agr. Expt. Sta. Rep.*, 1902, Part III, pp. 179–358.—During the year covered by this report, 1,867 samples of food products were examined by several members of the station staff. Of the 1,209 samples collected by agents of the station, 848 were not adulterated, 12 were compounds, 56 contained preservatives, and 291 were variously adulterated. The methods

employed in the analysis of many of the products are given. In experiments to determine the effects of roasting on the composition of cocoa beans, little or no change was observed in the contents of starch, fat, theobromine, caffeïne, and other nitrogenous substances due to this process. While chemical changes undoubtedly occur, they apparently would not interfere with the adoption of standards of composition based on analyses of beans roasted at a medium heat. Roasting increased the percentage of fiber and optically active substances in the shells and decreased the fat and starch. Analyses are reported of 17 authenticated samples of shelled cocoa beans and cocoa shells, some of the data being summarized in the following table.

COMPOSITION OF ROASTED COCOA NIBS AND SHELLS.

	Water.	Total ash.	Theobromine.	Caffeïne[1]	Crude fiber.	Crude starch.	Fat.	Total nitrogen.
Nibs:	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
Maximum	3.18	4.15	1.32	0.73	3.20	12.37	52.25	2.54
Minimum	2.29	2.61	0.82	0.14	2.21	9.30	48.11	2.20
Average	2.72	3.32	1.04	0.40	2.64	11.16	50.12	2.38
Shells:								
Maximum.....	6.57	20.72	0.90	0.28	19.21	13.89	5.23	3.17
Minimum	3.71	7.14	0.20	0.04	12.93	9.87	1.66	1.74
Average	4.87	10.48	0.49	0.16	16.63	11.62	2.77	2.34

Studies of the macroscopical and microscopical structure of various small fruits and the seeds of certain sorghums are reported, the primary object of which was to secure data for the detection of adulteration. Analyses of the sorghum seed are included. Chemical and botanical analyses are also reported of screenings from American wheat, and the different weed seeds found are described as regards appearance and structure.

H. W. LAWSON.

Report on the Examination of Foods, Drugs, and Public Water Supplies. BY R. O. BROOKS. *Trenton, N. J.*, 1903, 30 pp.—The results of analyses of 836 samples of foods, 616 samples of drugs, 24 miscellaneous samples, and 19 samples of water are reported. The extent of food adulteration was 40.8 per cent. and drug adulteration 60 per cent. H. W. LAWSON.

Pepper. BY R. E. DOOLITTLE. *Mich. Dairy and Food Dept. Bull. No. 94*, pp. 3–17.—The average of 45 analyses made by the author of whole black pepper of a number of varieties was as follows: Moisture 9.54, total ash 4.99, ash insoluble in hydrochloric acid 0.58, ash soluble in water 2.49, starch by diastase method 36.69, volatile ether extract 1.30, non-volatile ether extract 7.67, crude fiber 11.12, total nitrogen 2.11. The average of 25 analyses of whole white pepper was as follows: Moisture 9.87, total ash 1.69, ash insoluble in hydrochloric acid 0.19, ash soluble in water 0.34, starch by diastase method 54.87, volatile ether extract 1.17, non-volatile ether extract 6.46, crude fiber 4.17, and

total nitrogen 1.97 per cent. Analyses are also reported of pepper adulterants and of commercial samples of black and white pepper. H. W. LAWSON.

Lime-Juice and Catsup. Cereal Breakfast Foods. Canned Meats. Canned Vegetables. BY A. MCGILL. *Ottawa Lab. Inland Rev. Dept. Bulls. Nos. 83*, 19 pp.; *84*, 31 pp.; *85*, 8 pp.; *87*, 9 pp.—In these four bulletins are given the results of examinations of 27 samples of lime-juice, 27 of catsup, 30 of cereal breakfast foods, 99 of canned meats, and 100 of canned vegetables, together with information relating to the use of preservatives, and in Bulletin 84 a discussion of the analytical methods used in the examination of cereal foods. H. W. LAWSON.

The Chemical Composition of Nuts Used as Food. BY J. B. WEEMS AND ALICE W. HESS. *Contrib. Dept. Agr. Chem. Iowa State Coll. Agr. and Mech. Arts No. 4*, pp. 108–112.—This discussion includes several analyses made by the authors.
H. W. LAWSON.

Laboratory Method for Ordinary Chemical Examination of Waters for Irrigation and Domestic Purposes. *Cal. Agr. Expt. Sta. Circ. No. 8*, 4 pp.—A brief description of tests used in the examination of water for ordinary purposes. H. W. LAWSON.

Note on the Determination of Solids in the Analysis of Vinegars. BY W. FREAR AND C. P. BEISTLE. *Pa. Agr. Expt. Sta. Rep.*, 1902, pp. 165–168.—Drying in a water-oven at about 100° C. was compared with drying over sulphuric acid at ordinary room temperature. The average results of four comparative determinations by the two methods were, respectively, 1.39 and 2.03 per cent. This large difference was shown to be due to the volatilization or decomposition of constituents other than water, alcohol, and acetic acid by the ordinary method.
H. W. LAWSON.

Report of the Chemist. BY F. W. TRAPHAGEN. *Mont. Agr. Expt. Sta. Rep.*, 1902, pp. 57–67.—This includes analyses of a number of samples of grasses, flax, wheat, and alkali waters. The flaxseed showed a high percentage of oil. Wheat was found to remove a much greater quantity of fertilizing elements from the soil than was returned in the irrigation water from different streams. H. W. LAWSON.

Report of the Chemist. BY E. F. LADD. *N. Dak. Agr. Expt. Sta. Rep.*, 1902, pp. 12–33.—This report includes observations on the rate of evaporation from a water surface and analyses of wheat, corn, millet, and other farm products. Analytical data without comments are given for the experiments in progress in the selection of wheat for high contents of protein and gluten.

In general, corn having a high nitrogen content was grown from the seed selected by physical examination for this purpose.

H. W. LAWSON.

Report of the Chemist. BY F. T. SHUTT. *Canada Expt. Farms Rep.*, 1902, pp. 129–168.—This report includes analyses of samples of soil from British Columbia, Northwest Territories, Ontario, and Newfoundland; a study of the conservation of soil moisture in orchards which showed that soil moisture was much better conserved by cultivation than by cover cropping or permanent sod; and analyses of numerous samples of fodders and feeding-stuffs, insecticides, and fungicides, fertilizers, sugar-beets, flour, honey, butter, well-waters, etc. The analyses of honey from capped and from partly or entirely uncapped comb known to bee-keepers, respectively, as ripe and unripe honey, showed that the former contained from 4 to 5 per cent. less moisture than the latter. In an article by F. T. Shutt and A. T. Charron, in the *Transactions of the Royal Society of Canada* (Vol. 8, Sec. 3, pp. 35–46), to which reference is here made, comparative tests of methods of determining moisture in honey were reported. It was found that in drying solutions of honey in glass tubes on asbestos at atmospheric pressure and at temperatures of 98° and of 70° to 75° C. there was considerable dehydration of the levulose. Results in drying in platinum dishes on sand in a partial vacuum at 60° to 70° C. for twenty-four hours agreed closely with calculations from specific-gravity determinations. As drying on asbestos yielded higher results than drying on sand the decomposition of levulose was apparently induced by the asbestos. Similar results were obtained with mixtures of dextrose and levulose in solution.

H. W. LAWSON.

Distinguishing Red and White Oak by Chemical Analysis of Their Ash. BY E. B. KNERR. *Trans. Kansas Acad. Sci.*, **18**, 61.—"The representatives of the black oaks [red and willow oak] gave a much higher percentage of ash than those of the white oaks, ranging over thirty-two hundredths per cent. of the seasoned wood for the former, and less than twenty hundredths per cent. for the latter. This difference was found mainly in the quantity of lime and potash present, the red oaks showing about 20 per cent. more of lime and 5 per cent. more of potash in the ashes than did the white oaks. Bearing these considerations in mind we should have here a sure method for distinguishing disputed samples of white and red oak."

W. F. HILLEBRAND.

The Composition and Digestibility of Prairie Hay and of Buffalo Grass Hay. BY J. T. WILLARD AND R. W. CLOTHIER. *Trans. Kansas Acad. Sci.*, **18**, 59–60.—The results of feeding two steers with the above fodders are given in tabular form. Buffalo grass is "very much superior to any of the ordinary rough feeds and fodders. It is fully equal to Kentucky blue grass and but little inferior to red clover."

W. F. HILLEBRAND.

A Study of Dietaries at Lawrence, Kansas. By E. H. S. Bailey. *Trans. Kansas Acad. Sci.*, **18**, 49–53.—From a study of the dietaries of two students' clubs at the University of Kansas, the same tendency that appears in our southern states is shown—to eat too much fat, sugar, and starch. The proportions of protein to fat and carbohydrates were, 1 : 8 and 1 : 7.6.

W. F. Hillebrand.

Crystalline Liquids. By Fred B. Porter. *Trans. Kansas Acad. Sci.*, **18**, 54–56.—A chemical paper devoid of originality.

W. F. Hillebrand.

PATENTS.

MARCH 3, 1903.

721,682. Thomas A. Edison, Llewellyn Park, N. J. **Reversible galvanic battery.** A depolarizing electrode of nickel hydroxide as the active element, an oxidizable electrode of cobalt as the oxidizable material on discharge, and metallic mercury with the cobalt together with copper for preserving contact between the active particles, and an alkaline electrolyte.

721,693. Charles I. Goessman, Worcester, Mass. Assignor to Vellumoid Paper Co., West Va. Making **paraffin paper.** A moving sheet of fabric is treated first with a glutinous solution as animal glue, then to formaldehyde, next dried, fourth steamed, fifth, saturated with ammonia, dried again, and coated with melted paraffin or wax.

721,814. Anton Manhardt, Vienna, Austria, Hungary. Making **aluminum alloys.** First melts tin 12, antimony 0.2, phosphorus 0.09, copper 7.75, and magnesium 0.06, stirs in 100 parts of melted aluminum, adds sodium bicarbonate 0.06, and sulphur 0.04, and raises the temperature.

721,852. Richard Arens, Marxloh, Germany. Making **glue.** The bony material is treated first with sulphurous acid gas, then with aqueous sulphurous acid under pressure of $1^1/_2$ to 2 atmospheres till all lime salts are dissolved.

721,871. Byron E. Eldred, Brookline, Mass. **Pulverulent lime.** Slacks a portion of quicklime to a putty, and adds enough ground quicklime to absorb all the water.

721,961. Leo Marckwald, Charlottenburg, Germany. **Halogenizing organic fluids** as toluene. A halogen is applied to a portion of a mass of the material to be treated in a column-still, then additional portions are treated and mixed, and the halogenized substance is continuously withdrawn from the mixture.

721,999. Aubrey D. Charles, Bellows Falls, Vt. Obtaining **casein.** The curd is precipitated from milk by hydrochloric acid at a temperature of 120° F., then washed with dilute sulphuric

acid solution at 130° to 140° F., afterwards pressed and dried at 130° F.

722,050. Franz Schaar, Trier, Germany. **Printing cotton.** A resist of a metallic salt as zinc oxide is first printed, then an alkaline carbonate is sprayed on, the fabric is dried, dyed with a sulphur dye in an alkaline bath, then with indigo in an alkaline bath, and finally passed through bichromate.

722,091. Robert Esche, Arlon, Belgium. **Slow-burning wicks.** The wick is first impregnated with aqueous sodium silicate, dried and treated with sodium hyposulphite, again dried and treated with ammonium bichromate, and finally coated with vegetable wax.

722,148. Josepha Schiele, Brussels, Belgium. **Silver plating.** A preparatory electrolytic bath is used of sodium pyrophosphate and tin protochloride in combination with aluminum nitrate and magnesium with which the metals are coated before applying the gold or silver.

722,157. Claus A. Spreckels and Charles A. Kern, New York, N. Y. Assignors to Federal Sugar Refining Co., Jersey City, N. J. **Purifying sugar.** The impure sugar is mixed with a sulphonated essential oil and a hydrocarbon.

722,158. Similar to above, the impurities being separated.

722,198. Ralph Baggaley, Pittsburg, Pa. **Converting copper matte.** An air-blast is led under the copper and extraneous heat applied to the surface to prevent the formation of copper noses and to drive the impurities to a place of removal.

MARCH 10, 1903.

722,238. Hans Lutke, Hamburg, Germany. **Photographic emulsion.** An emulsion containing a gold sulphate and having from 30 to 50 per cent. of the silver bound to chlorine.

722,253. Marcus Ruthenburg, Philadelphia, Pa. **Reducing iron.** The comminuted ore is passed through a heat zone of less than reducing temperature, then in granular form through an atmosphere of deoxidizing gas, hot enough to effect reduction without fusion, and afterwards fusing the reduced metal.

722,254. As above, but fuses by an electric current.

722,270. Frederick C. Weber, Chicago, Ill. **Improving iron and steel.** Melts the iron or steel and adds thereto binary and ternary borides by which impurities are eliminated by chemical action. Borides are binary or ternary compounds of boron.

722,273. William D. Baldwin, Washington, D. C. **Solder.** Aluminum and antimony 5 per cent. each, and zinc 90 per cent.

722,275. Rudolf Berendes, Elberfeld, Germany. Assignor to Farbenfabriken of Elberfeld Co., N. Y. Process of making **methyl-**

ene citric acid. Citric acid is heated with chloromethylic alcohol and the resulting methylene citric acid separated.

722,276. Andrew Bergman, Chicago, Ill. **Butterine.** Fifty per cent. of lard and 20 of tallow are melted together and 30 per cent. of eggs thoroughly beaten in, the whole boiled fifteen to thirty minutes, cooled, churned, and worked in a machine.

722,336. Maurice C. M. Tixier, Paris, France. **Tar extract.** Mixes tar and an alkaline carbonate by melting them together at from 60 to 100° C., the alkali being added in small portions, dissolving the product in cold water, decanting, and precipitating by acid, and mixing the precipitate with successive quantities of alkaline carbonate till effervescence ceases.

722,454. Maurice Peryer, Christ Church, New Zealand. **Cleaning compound.** Fine clay 56, whiting 7, sugar 2, common salt 2, borax 1, ash $^1/_2$ part, and pearl 6.

722,455. August Prister, Gradisca, Austria-Hungary. **Precipitating gold** from cyanide solutions. Acidifies the solution, adds salts of mercury as a nitrate, then copper 7 parts to 1 of the gold remaining, then adds a little of the solution from the usual zinc cyanide process.

722,504. Charles H. Halcomb, New York, N. Y. **Steel.** A high-grade steel containing less than 1.2° of carbon, from 6 to 15 per cent. of molybdenum, 2.5 to 6 per cent. of chromium, and less than 2 per cent. of silicon.

722,506. Ludwig O. Helmers, Hamburg, Germany. Assignors to Ichthyol Gesellschaft, Cordes, Hermanni and Co., Hamburg, Germany. A **sulphonic acid compound** with a metallic base, derived from hydrocarbons free from sulphur and combined with sulphuric acid, which salts form a reddish brown, amorphous powder soluble in water, the solution being permanent, and give no color with ferric chloride in aqueous solutions.

722,507. Same as above, and for **oxidized-sulphonic acid salts** of similar character.

722,536. Franz Padberg, New York, N. Y. Assignor of one-half to Harry A. Schoonmaker, same place. Composition for **saving fuel.** Alum 2, soda 4, water 12, and oil 1 part.

722,626. Nicholas Reif, Wunsterf, Germany. **Plastic objects from peat.** A mixture of tar-oil and resin is forced into the peat, and the mixture treated with an oxidizing agent as sulphur chloride, when the whole is converted into a solid body.

722,630. Christopher Ris and Albert Mylius, Basle, Switzerland. Assignor to Anilin Color and Extract Works. **Yellow sulphur dye.** Light brown powders which are formyl derivatives of *m*-toluylene diamine are melted with sulphur and benzidine or its derivatives. Dye is soluble in hot, dilute caustic soda or sodium sulphide.

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722,708. Ernst E. Hippe, Copenhagen, Denmark. **Decorating stone.** A contour line is formed of an alkaline silicate between adjacent fields, one field being treated with color mixed in an oleaginous substance and the other with color mixed with a substance non-miscible therewith.

722,715. Myrtil Kahn, Elberfeld, Germany. Assignor to Farbenfabriken Elberfeld Co., New York, N. Y. **Black wool dye.** *o*-Amino phenol-*p*-sulphonic acid is coupled with 1-5 dihydroxynaphthalene, forming a dark brown powder soluble in water violet, turning blue by a little caustic soda-lye, but becoming violet by adding a large quantity, soluble in sulphuric acid, 66 Beaumé, violet-black growing light by adding ice, which gives a dark precipitate, dyeing wool from acid baths violet-red, changed to deep black by chrome.

722,716. All **as above,** substituting as first component the diazo-compound of *o*-amino cresol sulphonic acid, and forming a dye similar to the preceding.

722,719. Max Kugel, Wiesdorf, near Cologne, Germany. Assignor to Elberfeld Co., New York, N. Y. **Anthracene derivative.** α-Alphyl amino anthraquinone is treated with oxidizing agents, the hydroxy group being in alpha position to the alphylamino group, and producing 1-*p*-tolylamino 2-4-dihydroxyanthraquinone, crystallizing in dark, brilliant needles, soluble in hot glacial acetic acid, readily soluble in boiling pyridine blue, insoluble in caustic soda.

722,759. Joseph Scales, Niagara Falls, N. Y. **Subdividing blocks or ingots.** Assigned to Union Carbide Co., same place. Drills a hole in the block of carbide in the furnace and injects air or water into the hole.

722,762. John P. Schuch, Jr., Cripple Creek, Col. **Separating precious metals.** Passes solutions first through limestone, then through wood ashes or zinc and charcoal, to neutralize free acid, then through zinc to precipitate the precious metals, and through limestone to precipitate the zinc, and finally thorough filtration.

722,791. Edward G. Acheson, Niagara Falls, Canada. Assignor to the Acheson Co., same place. **Making refractory material.** Treats a mixture of carbon and silica to form silicon carbides as Si_7C_7O, Si_2C_2O, etc., in the electric furnace and then shaping the mass. One mixture may be carbon and silica, both powdered, one part to two.

722,792. **As above,** for heating a suitable mixture of carbon and silica.

722,793. **As above,** for refractory material, self-binding, containing silicon, oxygen, and carbon in chemical combination,

neutral towards acid or basic slags, insoluble in molten iron, unaffected by furnace gases, and reacting with hydrofluoric acid.

722,809. Francis R. Carpenter, Denver, Colorodo. Assignor to Joseph H. Berry, Detroit, Mich., of $^1/_2$. **Treating ores.** The precious metals in silicious ores are concentrated in a mass of metallic copper containing lead, and treated by a hot oxidizing blast, making impure cuprous oxide and a residue containing precious metal, partially reducing the cuprous oxide, thereby freeing it from lead, etc., forming a metallic bottom which is subjected to a hot oxidizing blast which recovers the silver, etc.

722,831. Otto Forsbach and Eduard Clerc, Mulheim-on-Rhine, Germany. **Crucible.** A delivery crucible is set over the one in the furnace through the bottom of which the heated crucible receives its charge.

722,832. Carl Fresenius, Offenbach-on-Main, Germany. **Purifying fats.** Mixes the fat with alkali and carbon as coal-dust, and heats under a pressure of 70 pounds.

722,857. Morris C. Lane, Bermondsey, England. Assignor to Peter Spencer and Son, Manchester, England. **Tanning.** Frees the hides from grease, and treats with a titanium compound, brushed on the flesh side only.

722,860. Ivan Levinstein and Carl Mensching, Manchester, England. Assignors to Levinstein Limited, same place. **Blue polyazo dye.** A new benzylated naphthylamine sulphonic acid is combined with a diazo derivative of an aminoazo compound. A black powder, soluble in water blue, and dyeing wool blue from acid baths.

722,861. **As above,** but for **benzylnaphthylamine sulphonic acid.** Obtained by heating $\alpha\alpha$-naphthylaminesulphonic acid with benzyl chloride.

722,869. Heinrich C. Meyer and Ernst Besenbruch, Harburg-on-Elbe, Germany. Assignors to H. C. Meyer, Jr., same place. **Bleaching cane.** (Rattan.) Treats rattan with a solution of 6 to 10 per cent. of a potassium salt, till outer coat is softened, then treats with bleaching-powder or a similar agent.

722,901. James E. Reynolds and George R. Grubb, Dublin, Ireland. **Photographic film.** Makes a solution of thio-urea 15 grams to a liter, adds six volumes of water to four of this solution and makes another of washed, freshly precipitated lead tartrate 75 grams to a liter containing about 40 grams of caustic soda, this solution being added to the first in the proportion of $^1/_{40}$ to $^1/_{60}$, coating glass by immersion and raising the coated plate to 140° F. till the liquid turns dark sherry color, adding a further quantity of the second solution cold, immersing in a bath at about 120° F., and allowing to cool.

722,944. Paul H. J. Chautard and Henri Kessler, Paris,

France. **Devulcanizing gums.** Dissolves vulcanized gum in phenol *in vacuo* at a temperature below 100° C., distilling off most of the phenol and separating the remaining sulphur and phenol by lead and alcohol or soda-lye, and washing the gum.

722,947. Herbert Cottrell, Newark, N. J. **Electrode for reversible galvanic battery.** The interior consists of layers of carbonized textile fabric used to absorb a solution of a metallic salt, and carrier of a metallic salt to be made active in the battery, and an exterior casing of carbonized textile fabric.

722,981. John B. F. Herreshoff, New York, N. Y. Assignor to General Chemical Co., same place. **Sulphuric acid.** Sulphuric anhydride is absorbed by cooled liquid sulphuric acid and a diluting agent as steam, water, or weak acid, is simultaneously supplied which keeps the resulting acid at the original strength.

723,007. Rudolf Muller and Otto Schwab, Hochst-on-Main. Assignors to Farbwerke, vorm. Meister Lucius und Bruning, same place. **Reducing indigo.** Treats indigo by an electric current in the presence of a sulphite solution at 60° to 100° C., and without a diaphragm.

723,011. Paul Naef. Appartus for **treating liquids with gases.** A column-still, provided with a temperature regulator for each compartment.

723,015. Wm. H. Orr, Lima, Ohio. **Wall plaster.** Water granulated dry furnace-slag 540, natural cement 480, Portland cement 100, fire-clay 300, calcined gypsum 520, wood-fiber dry 60, and stucco retarder 3 to 6 parts.

723,054. Wm. H. Smalley, London, England. **Photographic film.** A layer of sensitized gelatin, a thin covering layer of transparent non-sensitized gelatin, hardened, and a thin under layer of the same kind, the sensitive film between them.

723,088. William X. Warr, Staleybridge, England. **Fireproofing textiles.** Impregnates with sodium stannate, dries, then with titanium salt and dries, fixes with sodium silicate, washes and dries.

723,089. Edwin J. Watkins and Wm. J. Screeton, London, England, Watkins. Assignor to Edwin Loyd, same place. **Paint cleaner.** A boiled pulp of lemons 2, and hydrochloric acid is mixed with water 4, oxalic acid 2, and black treacle three pounds, butyric acid one ounce, and a mineral oil may be added.

723,105. Edward H. Williams, Sharon, Pa. **Reclaiming flue dust.** Iron-ore flue dust is melted with silica, forming a molten bath of iron oxide and iron silicate to the surface of which heat is applied while the dust is fed under the surface, thereby forming an iron slag that is removed as formed.

723,106. **As above** for a slag of iron oxide bound with pure iron silicate.

723,124. George F. Averill, Arverne, N. Y. Assignor to Wm. C. Lynne, and Joseph C. Frauenheim, Pittsburg, Pa. **Artificial lumber.** Paper dust 2, magnesium oxide and magnesium chloride 1 each, and linseed oil 2 to 15 per cent.

723,125. Oscar Bally, Mannheim, Germany. Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-am-Rhein, Germany. **Green anthracene dye.** A compound of nitro anthraquinone and sulphonated aromatic amines is halogenized, and the resulting product sulphonated. If *p*-toluidine and sulphanilido anthraquinone be used, the dye is soluble in water green, in alcohol and glacial acetic acid blue, and violet in concentrated sulphuric acid, dyeing green on chrome.

723,137. James C. Coleman and Elliott Toxey, Mobile, Ala. **Paper pulp.** Uses the entire cotton plant, roots, branches, leaves, seeds, and lint.

723,147. Alexander N. Dubois, Philadelphia, Pa. **Giving lisle thread finish to fabrics.** Impregnates the fabric with an acid aniline black mixture, which tends to carbonize the filamental fuzz on the surface, and then rolls the articles in a tumbling drum till the brittle fuzz is removed and the goods polished.

723,152. August Gurber, Wurzburg, Germany. **Concentrating solutions.** Centrifugates milk with simultaneous refrigeration, thawing the frozen part, centrifugating while frozen, freezing, and thawing alternately to condense the milk without heat.

723,154. Richard Herz, Frankfort-on-Main, Germany. Assignor to Leopold Cassella and Co., same place. **Blue sulphur dye.** Heats phenylamino hydroxydiphenylamine with polysulphides. The dye is a dark blue powder, soluble in weak aqueous alkaline sulphides green blue, and in concentrated sulphuric acid dark blue.

723,158-9. Thomas J. Webster, N. C. Assignor to Walter S. Adams, Waynesville, S. C. **Treating nickel ores.** Any iron is oxidized by HNO_3 as garnerite, and the ore dissolved in hydrochloric or sulphuric acid, calcium carbonate and ammonia added, and the precipitate removed, the nickel is precipitated as nickel sulphide and then converted into an oxide. In the second patent the nickel is precipitated as nickel oxalate.

723,197. Asahel K. Eaton, New York, N. Y. Assignor to Hugh M. Eaton, Brooklyn, N. Y. **Recovering tin.** Tin is heated in a bath of sodium bisulphate and the bath removed and electrolyzed to recover the tin.

723,198. Oscar Forster, London, England. **Printing surfaces.** Assigned to Universal Chromophoto Engraving Co.,

New York, N. Y. The stone or plate is coated with a sensitized film containing salts as zinc chloride, etc., that when dry crystallize out to form a fine surface grain; on this a picture is printed and developed in the usual way. A number of different solutions are required.

723,212. Paul A. Knappe, Grantville, Ga. Assignor to American Amalgamating Co., Boston, Mass. **Treating ores.** Feeds pulp to a settler and grades therein, withdraws the lighter portion before touching mercury, bringing mercury in contact with the heavier pulp particles, discharging the non-amalgamated portion thereof, and separately recovering the values from the different grades.

MARCH 24, 1903.

723,251. Charles A. Doremus, New York, N. Y. **Metallurgical furnace.** A horizontally rotating covered hearth on which the materials are spread, and burners placed radially within the furnace and extending over the surface of the hearth so as to project the flame issuing from them onto the hearth.

723,254. Henry V. Dunham, New York, N. Y. **Milk-powder.** Heat the milk to 200° F., then cool it rapidly, evaporate it to 25° Beaumé at about 110°, mix the condensed product with about the same amount of milk-powder already prepared, and dry and powder the mixture.

723,263. Hugo Gallinowsky, Philadelphia, Pa. **Acid-proof cement.** A fibrous material is saturated with a solution of magnesium chloride and silicic acid, equal parts, and dried and then mixed with a basic cement.

723,279. William E. Jacques, Grand Rapids, Mich. Assignor to Alfred O. Crozier, same place. **Glazed bricks.** The surface of the brick is covered with a coating of a metallic oxide and a flux, one each, mixed with cement, 7 parts, and silica, 75 parts, to which 12 parts water are added.

723,281. As above for an **artificial stone** made by the above process, with color added to the coating and compacted by pressure.

723,311. Robert Robertson and William Rintoul, Waltham Abbey, England. **Celluloid.** The process of recovering acetone from a mixture with air by saturating it with moisture, bringing it in contact with a solution of a bisulphite, and distilling off the acetone.

723,319. Franz Schubert, Ganstadt, Germany. Assignor to Johann Georg Held, Babberg, Germany. **Substance for filling hollow brake beam shoes.** Three parts each of asphalt and quartz, 1 each of leather and shellac and 2 of plaster of Paris are cooked to a pulp, which is then filled into hollow brake shoes.

723,326-7-8-9. Elmer A. Sperry, Cleveland, Ohio. Assignor to National Battery Co., same place. **Storage-battery plates.** The first for a woven fabric case for the anode, the second for a composition of finely divided lead and ammonium hydroxide, the third for finely divided lead, ammonium sulphate and alizarine, the fourth for an envelope of fiber freed from fat and starch and saturated with nitric acid 113 parts of 1.42 specific gravity and 150 parts of sulphuric acid of 1.84 specific gravity, washing the fabric and treating it with nitrobenzene.

723,363. Henry F. Campbell, Melrose, Mass. **Concentrating ores.** Heats the ore a short time to render it susceptible to magnetic influences and then applies electricity. May divide the process in two parts, first removing water and then silica, etc.

723,368. Theodore F. Colin, Elizabeth, N. J. **Desulphurizing petroleum.** Oxidizes the sulphur by a hypochlorite in alkaline solution in the presence of an oxygen carrier as manganese nitrate at ordinary or slightly elevated temperature, then removing the excess of chlorine by ferrous sulphate.

723,398. Ernest A. Le Sueur, Sault Ste. Marie, Canada. Method of operating an **electrolytic cell.** In cells with porous diaphragms the solution to be decomposed is fed to the anode compartment under pressure, whereby movement is produced towards the cathode through the diaphragm, and feeding water to the cathode compartment so as to displace an equivalent volume of alkaline solution.

723,448. Hans Eberling, Biebrich, Germany. Assignor to Kalle and Co., same place. **Brown sulphur dye.** Sodium sulphide and sulphur are melted at 115° C., amino derivatives of *m*-toluylene diamine are stirred in, the temperature raised to 121°, and the heat maintained till the melt is dry.

723,494. Adolph C. Schulz, Detroit, Mich. Assignor $^2/_3$ to George A. Fick and Frederick Wilhelm, Cincinnati, Ohio. **Artificial stone.** Burnt clay 5, gravel 6, and lime 9 parts. Mixed with water.

723,561. Helen M. Van Etten, Moravia, N. Y. **Artificial fuel.** Mineral coal 1000, bitumen 10, and alum 5 parts. May add whiting, 10 parts, as a binder.

723,594. Peter Eyermann, Benrath, near Dusseldorf, Germany. **Making steel.** Heats liquid pig iron on a hearth by blast-furnace gas, directs an air-blast on the surface of the metal for first refining, and then passes blast-furnace gas through glowing carbonaceous material and burns the same in the furnace to make a very high temperature.

723,595-6. William C. Ferguson, Flushing, N. Y. Assignor to General Chemical Co., New York, N. Y. **Sulphuric anhy-**

dride. Apparatus and process. A plurality of contact-chambers connected by pipes and an air-supply between the chambers so that air can be mixed with the gases while away from the catalytic substance.

723,601. Georg Grunauer, Berlin, Germany. Making **cast iron alloys.** Melts and draws off iron and on its way to the mold adds $^1/_2$ to 40 per cent. of nickel.

723,737. Cecil V. Schou, Copenhagen, Denmark. **Smoke generator for shrapnel.** Sublimed zinc 65 parts and flowers of sulphur 32 parts.

723,787. Sydney Trivick, Clapham, England. **Extracting metals.** Dry chloride of lime and a ferric salt are mixed and added to the furnace charge so as to make ferric hypochlorite and ferric chloride.

MARCH 31, 1903.

723,731. Albert L. Cole, West Newton, Mass. Assignor to Standard Packing Manufacturing Co., Me. **Semimetallic packing.** A metallic core of metal threads has a matrix of rubber and graphite, filling the interstices between the threads, the whole being vulcanized together.

723,928. Botho Schwerin, Berlin, Germany. **Electro-endosmotic extraction of sugar.** Saccharine material is placed, disintegrated and wet, between a layer of finely divided carbon on an electrode pervious to water, and a positive electrode surrounded by a mixture of earthy compounds and water, a current is passed through the stratified mass whereby the electrolytically non-dissociable bodies are driven towards the negative electrode, collecting the liquor percolating through the layer of carbon and its supporting electrode, and separating therefrom sugar.

723,949. George D. Van Arsdale, New York, N. Y. **Obtaining copper.** Sulphur dioxide is passed into solutions of hot cupric sulphate with or without pressure, whereby metallic copper and sulphuric acid are formed, and applying the sulphuric acid to the treatment of fresh ore to form the copper sulphate solution.

723,970. William M. Zitt, Chicago, Ill. Assignor to McConnell Asbestos Co., Pittsburg, Pa. **Non-conducting covering.** A light, voluminous, non-conducting covering of a salt of magnesia and magnesia hydrated while in process of molding.

723,990. Hermann Classen, Dormagen, Germany. **Boiling sugar solutions.** The oversaturation of thick or concentrated juice is systematically varied according to its purity empirically determined, establishing a decrease in oversaturation after formation of grain, followed by a systematic increase preparatory to boiling off according to the dropping purity of the mother-syrup.

724,012. Joseph J. H. Hunte, Charlton, England. Assignor to the Accumulator Industries, Woking, England. Making **accumulator plates.** Lead plates are arranged as anodes in an electrolyte of an alkaline sulphate containing in solution a metallic chloride and permanganate, whereby compounds of lead, oxygen and chlorine are made, which are broken up by electrolysis, the chlorine removed, the higher oxygen compounds reduced to lower oxides of lead whereby the original plates are converted into plates having a core of lead and a coating of lead oxide and a porous reduced lead, and these plates arranged as anodes are charged in the electrolyte bath.

724,020. Frederich Lehner and Alfred Lehner, Zurich, Switzerland. **Cellulose filament.** Passes viscose filaments through a sulphuric acid bath, then through an alkaline sulphide and bisulphite.

724,043. Soloman Richman, New York, N. Y. Assignor to National Enamel and Stamping Co., same place. **Enamel.** Feldspar 125, quartz 60, fluor spar 51, borax 150, soda 30, cryolite 15, saltpeter 10, magnesia 5, antimony oxide 8, and china-clay 6 parts by weight.

724,076. Jose B. De Alzugaray and Wm. A. Mercer, London, England. Assignors to the Gold Extraction Co., same place. **Apparatus for extracting gold.** A hermetically closed lead-lined cylinder adapted to contain a liquid chemical, and provided with a hard metal adjustable air inlet pipe to regulate the admission and impregnation of air with the chemical.

724,078. Albert Bertschmann, Basle, Switzerland. Assignor to the Society of Chemical Industry, same place. **Azo dye.** Nitrobenzamino naphtholsulphonic acid is first made by reacting with nitrobenzoyl chloride on 2-5-7-aminonaphthol sulphonic acid, heating the product with reducing agents, and combining the result with aromatic diazo bodies. The dye is soluble in water and dyes unmordanted cotton in a saline, neutral or alkaline bath from yellow-red to blue-red, developing well on the fiber by diazotation and ultimately combining with amines or phenols to form brilliant red shades.

724,094. Robert L. Gamlen, Bromley, England. **Incrustation preventative.** Introduces into the boiler wool fiber which has been reduced to a very fine state of division.

724,107-8. Edward D. Kendall, New York, N. Y. **Electrodeposition of gold and silver.** The first, potassium aurate with excess of alkali hydroxide and potassium ferrocyanide, the second, a silver salt, a thiosulphate and silicious powder for the baths.

724,140-1-2. John Stevenson, Jr., Sharon, Pa. **Rephospho-**

rizing steel and alloys. In the first, basic steel is tapped from an open-hearth furnace and receives an addition of iron containing a high proportion of phosphorus, carbon and manganese. The second substitutes alumina for the carbon, and the third is smelting a manganiferous iron with a phosphoric flux.

724,214. Wm. B. Smith, Plainfield, N. J. Assignor one-half to Harold P. Brown, Montclair, N. J. **Artificial fuel.** Residuum from acetylene gas-making is mixed with ash, cinder and ferric sulphate.

734,234. Wm. J. Armbruster, St. Louis, Mo. **Pigment.** Consists of molecular equivalents of barium carbonate and zinc hydroxide.

724,235. **As above** for process of making, by adding an alkaline hydroxide to zinc sulphate, and then barium sulphide.

723,238. Thomas Aspinall, Bolton, England. **Preparing sizing.** Caustic soda is added to starchy matter in a suspended state, then neutralized by an acid, mixed with china-clay, magnesium, and zinc chlorides and an oleaginous substance.

724,243. Frederick Baldt, Sr., Chester, Pa. **Fusible pattern.** Mixes lead, bismuth, and zinc in equal proportions.

724,251. Henry S. Blackmore, Mt. Vernon, N. Y. **Sulphuric acid and metallic oxides.** Dry, superheated steam is brought in contact with aluminum sulphate maintained below the temperature of decomposition of sulphuric acid, the resulting vapors being condensed. The equation is

$$Al_2(SO_4)_3 + 3H_2O = Al_2O_3 + 3H_2SO_4.$$

724,258. Henry J. Caldwell and James R. Barr, Earl Park, Ind. **Bleaching grain.** Steam is passed through a stream of falling grain which is afterwards subjected to sulphur fumes and a comparatively cool air-blast.

724,266. Emile Davenes, Sierra Madre, Cal. **Wrappers for fruit.** A mixture of green bone, water, and nitric acid is boiled and filtered, then cocoa-butter and petrolatum added and all thoroughly melted, and suitable pieces of paper are dipped therein.

724,311. Adolph Miethe, Charlottenberg, and Arthur Traube, Berlin, Germany. **Panchromatic dry plate.** A light sensitive film is combined with the dyes obtained from the iodine ethylates of quinoline and quinaldine.

724,317. Charles E. Munroe, Washington, D. C. Assignor to Kuhn Formaldehyde Generator Co., Va. **Coating with metal.** Asbestos is immersed in an alcoholic solution of platinic chloride, and an alcoholic solution of ammonium chloride, and is subsequently heated.

724,331. Alphonso Raymond, Thomas Lowther, and David Perry, Bebrik, Russia. **Incrustation preventive.** Digests leguminous plants in caustic alkali, strains, and to the liquid adds the ground seeds as pea meal, strains, concentrates, and adds absorbent material as dry moss or peat.

724,387. Wm. Gardiner, Chicago, Ill. **Storage-battery plates.** The lead plates are made positive electrodes in an electrolyte of sulphuric acid, aluminum sulphate, a nitrate, and an oxalate.

724,411. Wm. Muir, Edmonton, and Charles R. E. Bell, Bromley, England. **Match composition.** Allotropic phosphorus, potassium chlorate, a mineral powder, and a binder, as glue, etc. WM. H. SEAMAN.

REVIEW OF AMERICAN CHEMICAL RESEARCH.

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WILLIAM A. NOYES, Editor.

GENERAL AND PHYSICAL CHEMISTRY.

On the Electrical Conductivity of Solutions in Amyl Amine. BY LOUIS KAHLENBERG AND OTTO E. RUHOFF. *J. Phys. Chem.*, 7, 254–258.—Amyl amine, a substance of small dielectric constant (4.5), and very small electrical conductivity, dissolves readily a number of salts. The solutes may be divided into two classes. One represented by copper oleate, does not increase the conductivity of the solvent. The other produces solutions which are comparatively good conductors. Of this class three were studied, silver nitrate, cadmium iodide and ferric chloride. The conductivity was found to be small compared with aqueous solutions but much larger than that of solutions in other solvents of similarly low dielectric constant, such as chloroform and ether. Each of the first two salts gave a maximum of molecular conductivity with dilution. The same result might have been obtained with ferric chloride, if concentrated solutions could have been tried readily, for in this case as in the others the molecular conductivity of dilute solutions decreased very rapidly with dilution. For example, the value for cadmium iodide is 200 times as great in normal as in fifth-normal solution. This very important phenomenon, which has been observed in other cases, especially in non-aqueous solutions, the authors regard as a strong argument against the Arrhenius dissociation theory and they hint at a theory of their own which, however, they do not develop. The phenomena attending the solution of the salts point to a union of amyl amine with the solids to produce new compounds analogous to hydrated salts. Comparing amyl amine with methyl amine and ammonia, the authors conclude that in this homologous series the dissociating power decreases with increasing molecular weight.

G. N. LEWIS.

The Reliability of the Dissociation Constant as a Means of Determining the Identity and Purity of Organic Compounds. BY HEYWARD SCUDDER. *J. Phys. Chem.*, 7, 269–299.—Reviewing the literature concerning the dissociation constants of organic acids, and citing a large number of data found by different investigators, the author shows that in many cases the value of the dissociation constant is a moderately reliable aid to the identification of acids but that the agreement between the values of the constant at different dilutions is not a satisfactory guide as to the purity of a compound, on account of the possibility of large experimental error and on account of the fact that many pure organic acids show a marked increase in the constant on dilution.

G. N. LEWIS.

Note on the Identification of Basic Salts. BY W. LASH MILLER AND FRANK B. KENRICK. *J. Phys. Chem.*, 7, 259–268.—The authors show how the phase rule may be used to give information concerning the constitution of such precipitates as basic salts. If, for example, a system of three components is studied, such as bismuth nitrate, nitric acid and water, there will not be, in general, more than two solid phases in equilibrium with a solution at any given temperature and pressure. If, therefore, in different experiments, the solutions are identical in composition, while the composition of the precipitate varies, the precipitate is a mixture of two phases. If the solutions differ in composition while the precipitates do not, the precipitate is a single chemical compound. If both solutions and precipitates vary, the precipitate is a single phase of variable composition, a solid solution. It is further shown how similar considerations may be applied to more complicated systems. Since these principles hold only for systems in equilibrium, the practical obstacle to their application lies in the very slow attainment of equilibrium in the majority of cases in which such methods would be needful. G. N. LEWIS.

The Compensation Method of Determining the Rate of Oxidation of Hydrogen Iodide. BY JAMES M. BELL. *J. Phys. Chem.*, 7, 61–83.—If a reaction produces a substance A, such that it may be titrated against a substance B, the speed of the reaction may be determined by adding in advance a known quantity of B, together with an indicator, and then finding the time required to produce enough A to neutralize it. This is called by the author the compensation method. He discusses a number of researches on the rate of oxidation of hydrogen iodide in which this method has been used with thiosulphate as compensator, and points out that the method is applicable only in case "(1) that the thiosulphate reacts only with the iodine liberated by the action of the oxidizing agent on the hydriodic acid, and (2) that its presence in no way influences the course of that action." Experiments are described which show that when H_2O_2 is the oxidizer

as in the researches of Harcourt and Esson, these conditions are probably fulfilled, but in other cases the thiosulphate is itself oxidized at a considerable rate. Equations are developed for the rate of reaction, assuming that both iodide and thiosulphate are oxidized simultaneously and independently, but these prove inapplicable to the cases studied in which chloric, bromic and chromic acids were used to oxidize. In all these cases the thiosulphate is oxidized but at a rate which is retarded by the presence of iodide and dependent on the concentration of the latter. This retardation is sometimes sufficient to make the compensation method approximately reliable. "In addition, the paper contains a number of measurements on the rate of oxidation of sodium thiosulphate by chloric and chromic acids, with particular reference to the effect produced by adding catalytic agents, and by changing the concentrations of the thiosulphate, the acid, and the oxidizing agent. The results do not suggest any simple 'mechanism' for the reaction." G. N. LEWIS.

The Rate of Reaction in Solutions Containing Potassium Iodide, Potassium Chlorate and Hydrochloric Acid. BY W. C. BRAY. *J. Phys. Chem.*, 7, 92–117.—This paper, apparently written in some haste, contains a considerable number of experimental data from which the following conclusions are drawn. The reaction in question is greatly catalyzed by ferrous sulphate. If, in the iodometric determination of chlorates, ferrous sulphate be added, the use of a digesting bottle may be dispensed with. The rate of the original reaction is proportional to the concentration of the chlorate, and to the square of the concentration of the hydrogen ion (within limits). It is accelerated by the chlorine ion by an amount proportional to the concentration of the latter. Changing the concentration of the iodide produces strange results; as the concentration increases the rate at first diminishes and then increases almost linearly. The speed of reaction is doubled by 8.6° rise of temperature. In explanation of his experimental results the author suggests two reactions occurring simultaneously. He offers, however, no arguments for the reactions which he chooses. G. N. LEWIS.

The Rate of Oxidation of Potassium Iodide by Chromic Acid. BY RALPH E. DELURY. *J. Phys. Chem.*, 7, 239–253.—A study of the rate of the reaction between bichromate, iodide and sulphuric acid at 30° showed that this rate is proportional to the concentration of the bichromate and approximately to the square of the concentration of the acid. With changing amounts of iodide, the rate changes more than it would if proportional to the concentration of the iodide and less than if proportional to the square of that concentration. The author suggests that this may indicate the simultaneous occurrence of two reactions, but he suspends judgment until further experiments are made. A series

of experiments at 0° gave results similar to those obtained at 30°. The temperature has an unusually small influence upon the reaction velocity, the quotient for 10° being only 1.4. Experiments were made on the rate of the reaction in the presence of a number of other salts, of which ferric sulphate alone possessed pronounced catalyzing power. G. N. LEWIS.

Note on the Variation of the Specific Heat of Mercury with Temperature. Experiments by the Continuous-Flow Method of Calorimetry. BY H. T. BARNES AND H. L. COOKE. *Phys. Rev.*, **16**, 65–71.—With the precise method of continuous flow (this Rev., **23**, 189) the authors have carefully executed a few experiments on the specific heat of mercury and especially its change with the temperature. For Js, the specific heat expressed in joules per degree, or mayers, the following equation is obtained :

$$Js_t = 0.140154 - 4.462 \times 10^{-5}t + 0.0157 \times 10^{-5}t^2.$$

Subject to a very slight correction, not yet applied, these figures refer to the hydrogen thermometer. The decrease in specific heat with the temperature is in close agreement with the earlier work of Winkelmann and of Milthaler. G. N. LEWIS.

Some Optical Properties of Iodine, III. BY WM. W. COBLENTZ. *Phys. Rev.*, **17**, 51–59.—Continuing his investigation of the absorption spectrum of iodine under varying conditions (this Rev., **25**, 268) the author was enabled, by means of cells made of pure, thin quartz plates, to study the ultra-red spectrum as far as wave-length 16μ, at which point rock salt begins to absorb heavily. Solutions in ethyl alcohol, in acetic acid and in both chloroform and carbon disulphide were studied as types, respectively, of the brown, of the red-brown, and the violet solutions. In the first two cases the solutions absorb more than the pure solvents, and absorption bands due to the iodine appear. In the two last solutions, the transmission curves coincide throughout with those of the solvents, showing that iodine in violet solutions is transparent through the whole ultra-red. G. N. LEWIS.

MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

The Origin of Coral Reefs as Shown by the Maldives. BY J. STANLEY GARDINER. *Am. J. Sci.*, **16**. 203–213 ; figure.
W. F. HILLEBRAND.

The Occurrence of the Texas Mercury Minerals. BY BENJAMIN F. HILL. *Am. J. Sci.*, **16**, 251–252.—These minerals are found in both the Upper and Lower Cretaceous rocks of Terlingua, Brewster County, in proximity to volcanics. The deposits of the Lower Cretaceous, which are at present the most important, occur in decomposed and brecciated zones in the Edwards and

Washita limestones, which zones are often contiguous to fissure veins that may have served as channels for the ore-bearing solutions. These fissures are also often ore-bearing, and are always filled with calcite, besides which are found gypsum, iron oxides, manganese, and sometimes much aragonite. Quartz crystals are never found with the ore. Cinnabar, the principal mercury mineral, occurs at times in beautiful ruby-red crystals associated with calcite and native mercury, also in granular crystalline masses, and again in large amorphous masses, varying in color, like the granular masses, from vermilion to dark reddish brown. Some cavities have yielded as much as 20 pounds of native mercury filling interstices between crystalline masses of calcite. It "is also present in the clay filling of seams and in one instance in a close-grained limestone." Calomel occurs sparingly with the same association as the native mercury, and also generally with a little terlinguaite. Terlinguaite with two other new minerals (see next abstract) "have been found in only one locality, which was a vug in a calcite vein. The material was associated with considerable mercury and what is locally known as amalgam, a mixture of cinnabar and native mercury."

In the Upper Cretaceous, cinnabar and native mercury are the only mercury minerals found, and calcite is a less frequent associate, but pyrite occurs in some quantity, which is not the case in the Lower Cretaceous. W. F. HILLEBAND.

Eglestonite, Terlinguaite and Montroydite, New Mercury Minerals from Terlingua, Texas. BY ALFRED J. MOSES. *Am. J. Sci.*, 16, 253–263; figures.—I. *Eglestonite, an isometric oxychloride of mercury.* In crystals resembling sphalerite, rarely exceeding 1 mm. in diameter, associated with terlinguaite, montroydite, calomel, native mercury, and calcite. System isometric, class hexoctahedral. Forms observed: 100, 110, 112, 123, with the dodecahedral planes the largest. Luster, brilliant adamantine to resinous. Color, varying between brownish yellow and yellowish brown, but darkening quickly on exposure to sunlight and becoming nearly black but retaining a high luster. In powder, greenish yellow to canary-yellow, becoming quickly green and finally black on exposure to light. Transparent, if smooth-faced. Brittle and without observed cleavage. Hardness, between 2 and 3. Specific gravity of two picked samples, 8.309 and 8.345. Heated on charcoal, volatilizes completely without fusion and forms a slight grayish sublimate. In the closed tube, decrepitates, becomes orange-red, evolves dense white fumes and deposits a white, non-crystalline sublimate which is slightly yellow hot, drives without fusing, is soluble in nitric acid and gives the chlorine tests with copper oxide. Later the orange-red residue volatilizes completely, forming a mercury mirror beyond the ring of chloride. In dilute nitric acid, the crystals become opaque

and pinkish white but retain their shape, and there is a visible formation of metallic mercury. On heating, the mercury dissolves with effervescence and the pinkish white residue is slowly but completely dissolved. In cold hydrochloric acid the crystals do not whiten, but in hot acid the surface becomes gray from metallic mercury, which dissolves with a very slight effervescence. The greater portion of the crystal is insoluble even in concentrated cold acid. If hydrochloric acid is added during the dissolving in nitric acid, there is a heavy precipitate formed, which on heating dissolves quickly and completely, as does also the white residue. The composition is:

	I.	II.	III.	IV.	V.
O	2.60	2.26	....	....	....
Cl	8.72	7.24	7.81	7.68	8.20
Hg	88.67	90.45	90.72	88.25	89.70

The average of these results leads to the ratio O : Cl : Hg = 2.036 : 3 : 6.005 and the formula $Hg_6Cl_3O_2$. Named after the late Prof. Thos. Egleston.

2. *Terlinguaite, a monoclinic oxychloride of mercury.* Usually as an aggregation of imperfect striated crystals, and less frequently as doubly terminated crystals, not over 1 mm. in length and of complex form.

Axial ratio: $\breve{a} : \bar{b} : \dot{c} = 0.5306 : 1 : 2.0335$. Angle $\beta = 74° 16'$.

Closely associated with eglestonite, montroydite, and native mercury. Luster, brilliant adamantine. Color, sulphur-yellow with a slightly greenish tinge, very slowly darkening on exposure to an olive-green. Color of powder, lemon-yellow, also slowly becoming olive-green. Transparent, or nearly so. Hardness, between 2 and 3. Brittle or sub-sectile. Specific gravity of picked samples, 8.728 and 8.723. Between crossed nicols there is distinct double refraction. The crystals can be viewed only normal to the $\bar{b}$ axis and show extinction parallel to this. On charcoal and in the closed tube, behaves like eglestonite, except that a little oxide appears to be formed, giving a pinkish tinge to the white sublimate. In nitric acid, behaves like eglestonite but dissolves more readily. In hydrochloric acid, becomes white but does not appear to dissolve. The most convenient distinctions are the yellow color and the very slow change of color to olive-green as compared with the brownish color and rapid change to black of eglestonite. In testing, the double refraction and the more rapid solution of the terlinguaite are characteristic. Hitherto the name terlinguaite (this Journal, **24**, R 73–74) has been applied to possibly three different substances. The composition is:

	I.	II.	III.	IV.
O	....	....	....	3.47
Cl	7.78	...	8.00	....
Hg	88.67	87.38	88.64	....

These values lead to the ratio O:Cl:Hg=0.974:1:1.983 and the formula Hg_2ClO.

3. *Montroydite, mercuric oxide in orthorhombic crystals.* Associated sparingly with eglestonite and terlinguaite, usually "as a velvety incrustation of orange-red needles projecting from the surface of little hollow spheres and hollow pipe-like stems. The supporting material forming the sphere or pipe was metallic in luster, white to gray in color, and although possessing very much the solidity of a soft amalgam and spoken of by Mr. Hill as a mixture of cinnabar and mercury" (see preceding abstract), "was nevertheless entirely volatile, and so far as qualitative tests went was simply metallic mercury." Occasionally, larger needles of a darker red color were observed, usually poorly developed but now and then well formed, highly modified, and measurable. The ratio of $\breve{a}$ to $\dot{c}$ is 0.63797 to 1.1931, $\bar{b}$ undetermined, apparently. Luster, adamantine to vitreous. Transparent. Color of larger crystals, a darker red than crocoite and nearer realgar; minute crystals, orange-red. Color of the powder, a little lighter than color of crystals. Not noticeably affected by sunlight. Brittle. Hardness, less than 2. Closed-tube and wet reactions as for mercuric oxide. Analysis gave: Loss on heating in closed tube, 7.13; sublimate, 92.87. Named after Mr. Montroyd Sharpe, owner of mines at Terlingua.

Square prismatic and tabular crystals of calomel were measured, and another yellow mercury mineral was examined which could not be identified, though it seemed to be an oxychloride different from those already described. It appears in small, yellow needles and short, prismatic crystals which do not change color noticeably on long exposure.

W. F. HILLEBRAND.

Preliminary Note upon the Rare Metals in the Ore from the Rambler Mine, Wyoming. BY THOMAS T. READ. *Am. J. Sci.*, **16**, 268.—Palladium appears to be associated with covellite and platinum with chalcopyrite. The palladium does not appear to occur in the native state and it is suggested that perhaps it may be in combination with sulphur as Pd_2S.

W. F. HILLEBRAND.

Nepheline Syenite in Western Ontario. BY WILLET G. MILLER. *Am. Geologist*, **32**, 182–185.—The discovery of this rock not far from the east shore of Sturgeon Lake, about 75 miles northward of Ignace Station on the Canadian Pacific Railway, extends very considerably its known limits in Ontario. Nepheline is now recognized as a widely distributed rock constituent in the Archaean districts of the Province. The megascopic minerals are: Feldspar, nepheline, black mica, magnetite, apatite, pyrite. Microscopically, according to Professor Brock, "the rock is a hypidiomorphic granular one, consisting essentially of microper-

thite, microcline and hydronephelite, nepheline, with some biotite, amphibole and a little diopside(?). A little magnetite and some calcite secondary after the pyroxene are also present." An imperfect analysis by A. G. Burrows, in which titanium does not appear and the oxides of iron are reported as FeO, shows the following composition: SiO_2, 55.64; Al_2O_3, 19.81; FeO, 3.90; CaO, 2.86; MgO, 0.95; K_2O, 4.60; Na_2O, 8.21; P_2O_5, 0.103; moisture, 0.35; ignition loss, 3.14; total, 99.563.

W. F. HILLEBRAND.

Some Volcanic Ash Beds of Montana. BY JESSE PERRY ROWE. *Univ. of Montana Bull., No. 17, Geol. Series, No. 1*, 32 pp.; figures and plates.—Volcanic ash beds are found over a large part of the state and frequently find commercial use. Many of them are noted by counties, but without the slightest statement as to their mineral composition. The only new chemical matter is an imperfect analysis of ash from Ravalli County, in which, though characterized as made with care by O. J. Berry, no mention is made of calcium, titanium, or phosphorus, and the oxides of aluminum and iron are not separated.

W. F. HILLEBRAND.

On a New Lilac-Colored Transparent Spodumere. BY GEORGE FREDERICK KUNZ. *Science*, **18**, 280; *Am. J. Sci.*, **16**, 264–267; plate.—Associated with colored tourmaline in a new locality near the famous deposits of lithia minerals in San Diego County, California, are found enormous crystals of spodumene, weighing up to 1 kilogram and remarkable besides for their beautiful color tones, which vary from deep rosy lilac in depth to colorless at the surface. Smaller, similarly colored crystals are also found at the White Queen mine, Sec. 24, T. 9 S., R. 2 W. of the San Bernardino meridain, California. Spec. grav., 3.183 as the mean of determinations on three crystals. Hardness, about 7. The papers in the two journals are not identical and contain several apparent contradictions or ambiguities.

W. F. HILLEBRAND.

Kunzite, a New Gem. BY CHARLES BASKERVILLE. *Science*, **18**, 303–304.—To the above-described gem, the name kunzite is given and an analysis is promised. Its behavior towards Röntgen rays of high penetration is described. No fluorescence occurs, but on removal to a dark room a persistent white luminosity is observed, which is new to this class of minerals. The excitation produced by X-rays is not superficial, but persists throughout the mass.

W. F. HILLEBRAND.

The Lignite Fields of North Dakota. *Second Biennial Rep. State Geol. Survey North Dakota*, pp. 33–207; maps, plates, figures.—This series of papers, chiefly by the State Geologist,

Frank A. Wilder, makes up the bulk of the survey report. There are 60 new proximate analyses of lignites, which show about the same averages as the first report (this Journal, **24**, R 77). W. F. HILLEBRAND.

Water Resources of the Devil's Lake Region. BY E. J. BABCOCK. *Second Biennial Rep. State Geol. Survey North Dakota*, pp. 208–250; maps, plates, figures.—The character of a number of well and other waters is indicated by chemical tests, and there is an analysis of an artesian water from a well at Devil's Lake. W. F. HILLEBRAND.

[The Secondary Character of Chalcocite.] BY MARTIN SCHWERIN. *Eng. Min. J.*, **76**, 383.—"The most striking peculiarity marking the low-grade Capote [Cananea, Mexico] ore is that nearly all of the pyrite is coated with a microscopically thin film of chalcocite, which extends even to the planes of fracture. And on breaking a piece down to the most minute particles, at least one of the small new faces exposed is seen to be similarly coated. This peculiarity affords the clearest evidence that I have yet had an opportunity of observing, of the secondary character of chalcocite." W. F. HILLEBRAND.

BIOLOGICAL CHEMISTRY.

Influence of Rennin upon the Digestion of the Proteid Constituents of Milk. BY P. B. HAWK. *Am. J. Physiol.*, **10**, 37–47.—The results of this investigation show that rennin inhibits the gastric digestion of milk, but that rennin ash does not possess this inhibitory action. The inhibitory action of rennin upon the digestion of milk proteids is not modified by preliminary contact with pepsin solution at 40° C. for one-half hour. Paracasein is somewhat more difficult of digestion than casein. Rennin retards the pancreatic digestion of milk proteids in alkaline or neutral solution. Rennin has no inhibitory action upon the gastric digestion of fluid egg albumin. F. P. UNDERHILL.

Further Communications on Epinephrin. BY JOHN J. ABEL. *Ber. d. chem. Ges.*, **9**, 1839–1847.—A continuation of the investigations of this author on epinephrin, an abstract of which has already appeared in this review. F. P. UNDERHILL.

The Effect of Lecithin on the Growth of the White Rat. BY SHINKISHI HATAI. *Am. J. Physiol.*, **10**, 57–67.—The white rats which receive the lecithin by either injection or feeding, gain in body weight more rapidly than those which do not receive it, the gain in the experimental rats being, on an average, 60 per cent. greater than in the controls; the relative weight of the central nervous system in the lecithin rats is normal; the nervous

system in the experimental rats contains the same proportion of solids and water as in the controls; this is another indication of the normal character of the growth; the relative area of the axis cylinder to its sheath in the nerve fibers of the experimental animals is approximately the same as that in the controls, showing that the peripheral nerves have also grown normally; the rats which received the lecithin show a greater power of resistance to the unfavorable changes in the surroundings; the present investigation confirms strongly the previous observations of Danielewsky, Desgrey, and Zaky, and others who claim the physiological effect of the lecithin to be that of a stimulating agent for normal growth. F. P. UNDERHILL.

On the Action of Phlorhizin. BY PERCY G. STILES AND GRAHAM LUSK. *Am. J. Physiol.*, **10**, 67–80.—If phlorhizin be administered in 2-gram doses every eight hours to fasting dogs, there is a preliminary sweeping out of the body's sugar, and thereafter there is established a ratio between nitrogen and dextrose, in the urine, of 3.75 : 1 (or 3.60 to 3.70). After feeding meat, gelatin or casein, the ratio is unchanged in the aggregate, although the sugar tends to be eliminated before the nitrogen belonging to the proteid-fed. Dextrose, fed in small quantities *per os* or injected subcutaneously, is not burned, but eliminated quantitatively. Phlorhizin diabetes is a total diabetes. Dextrose within limits cannot be burned. It seems possible to accept Loewi's hypothesis of a blood-sugar combination, with the additional hypothesis that the sugar while in this combination cannot be burned. Phlorhizin will decompose it and permit the elimination of the sugar in the kidney. Any free dextrose unites with the combining radical and is protected. If the quantity of sugar rises above the combining power, immunity from destruction is lost and the sugar burns. If phlorhizin diabetes is to be produced, animals with sound kidneys are essential. The same animal should never be used at different dates, for the first experiment may have done violence to the kidneys and the 2.8 ratio is likely to be obtained. In this case the kidney has lost the power of splitting a dextrose combination formed from a definite percentage of the proteid sugar, a compound which is always burned in animals having the lower ratio. F. P. UNDERHILL.

On the Influence of Peptone-Blood upon Hemolysis and Bacteriolysis. Remarks upon Blood Coagulation. BY ALBION WALTER HEWLETT. *Arch. f. Exp. Path. u. Pharm.*, **49**, 307–324.—An experimental study of the influence of peptone blood upon hemolysis and bacteriolysis, the results of which confirm the views of Buchner, Gruber and Wassermann, that the bacteriolytic and hemolytic constituents of the blood are performed in the blood plasma. A discussion of the theories of blood coagulation is also given. F. P. UNDERHILL.

On the Artificial Circulation of the Isolated Kidney and the Influence of Defibrinated Blood upon the Secretion of the Kidneys. BY FRANZ PFAFF AND MAURICE VEJUX-TYRODE. *Arch. f. Exp. Path. u. Pharm.*, 49, 324–342.—Defibrinated blood cannot be employed as a means of studying the normal process of urinary secretion, since in both the isolated and normal organ defibrinated blood gives rise to a pathological secretion. Out of 131 experiments performed by these investigators, in not a single instance was a normal secretion obtained.

F. P. UNDERHILL.

Respiration Experiments in Phlorhizin Diabetes. BY ARTHUR R. MANDEL AND GRAHAM LUSK. *Am. J. Physiol.*, 10, 47–57.—The conclusions drawn from the research are that the calories lost in the urinary sugar in diabetes are compensated for in the increased proteid metabolism. In a diabetic dog, whether he be fasting, or fed on meat alone, or on fat alone, or on meat and fat together, no more fat is burned than in the same dog when he is normal and fasting. After the injection of 5 grams of phlorhizin subcutaneously, as much as 60 per cent. of the phlorhizin carbon may be eliminated in the urine. In the early stages of diabetes due to phlorhizin, the carbon in the urine derived from oxybutyric acid or other abnormal products, except sugar (and phlorhizin itself), appears to be negligible. F. P. UNDERHILL.

Observations on the Coagulation Time of Blood and the Blood Plates. BY JOSEPH H. PRATT. *Arch. f. Exp. Path. u. Pharm.*, 49, 299–307.—See *J. Med. Research*, 10 (new series, 4), 120–127; also this review wherein will be found an abstract of the article. F. P. UNDERHILL.

On the Optical Activity of the Nucleic Acid of the Thymus Gland. BY ARTHUR GAMGEE AND WALTER JONES. *Proc. Roy. Soc. Lon.*, 72, 100–104.—Solutions of the nucleic acid of the thymus gland, prepared according to the methods of Kossel and Neumann, are powerfully dextro-rotatory. The specific rotation of neutral solutions does not vary appreciably with dilution, the variations in the results of the observations given falling within the probable limits of error. The rotation is notably influenced by the acidity of the solution; it reaches a maximum at a certain degree of acidity and then decreases. On the other hand, the addition of ammonia in sufficient proportion will render a solution of thymus nucleic acid optically inactive, though neutralization of the acid will restore its pristine activity.

F. P. UNDERHILL.

SANITARY CHEMISTRY.

The Composition of Sewage in Relation to Problems of Disposal. BY GEORGE W. FULLER. *Technology Quarterly*, Vol. 16,

No. 2, pp. 132–160.—The writer of this paper has collected and tabulated the best available data showing the amount of the chief constituents of sewage, per capita, per day. These include data to be found in the lectures of the late Dr. Letherby, reprinted in a book called "The Sewage Question," published by Balliere, Tydall and Cox, London, 1872; Results obtained by Dr. Hoffman and Mr. Witt in 1857 in their inquiries into the average composition of London sewage; data obtained by Mr. Way, from ninety-three analyses of Rugby sewage, made from 1861–1863; the conclusions formed by Mr. Stearns and published in Mass. State Board of Health Report for 1890; the results of Professor Barmeister, published in his book on "Cleaning and Sewerage of Cities," 1891, and translated into English by John Goodell, 1892; the report of the constituents of sewage per capita daily, in the Mass. State Board of Health Report for 1894, and the paper of Mr. X. H. Goodnough, in the just published report, relative to the Charles River dam at Boston. From all the above published records, giving due weight to those data which are based on the most analyses, the following table is compiled:

ESTIMATED APPROXIMATE AVERAGE AMOUNTS OF THE PRINCIPAL CONSTITUENTS OF SEWAGE BASED ON FOREGOING DATA AND EXPRESSED IN GRAMS, PER CAPITA, DAILY.

Oxygen consumed. Two minutes' boiling	15.0
Oxygen consumed. Five minutes' boiling	22.0
Nitrogen as free ammonia	7.0
Nitrogen as albuminoid ammonia	2.5
Organic nitrogen	8.0
Total nitrogen	15.0
Chlorine	19.0
Fats	19.0
Dissolved matters, total	136.0
Dissolved matters. mineral	99.0
Dissolved matters, organic and volatile	37.0
Suspended matters, total	93.0
Suspended matters, mineral	53.0
Suspended matters, organic and volatile	40.0
Total solids, total	229.0
Total solids, mineral	152.0
Total solids, organic and volatile	77.0

Tables are also given showing the average composition of the sewage of four Massachusetts cities, Framingham, Gardner, Marlboro and Worcester, also of the English cities of Manchester, Leeds, Leicester, London, northern outfall, London, southern outfall, and a table showing the quantities of principal constituents in grams per capita, daily, of the sewage of the above cities. As regards the analysis of sewage, the writer states that there have not been many important changes as to methods, during the past thirty years, and that one of the unfortunate features at present, regarding data on the composition of sewage, is the inadequateness with which analytical methods measure the capacity of the

organic matter for consuming oxygen in connection with both filtration and dilution processes for treating sewage. Concerning the disposal of sewage into streams and ponds, the writer, after giving the statement made by Dr. Letheby in 1867, that English sewage, if diluted, with at least twenty volumes of water, will not only be made inoffensive, but will be thoroughly destroyed after flowing twenty miles, gives the opinion of the River Pollution Commission of Great Britain, 1878, that no river in that country was long enough to allow a complete disappearance of sewage matter discharged into it, and Mr. Rudolph Hering's conclusion (Proceedings of American Health Association, 1888) "that to render sewage inoffensive to communities situated on a stream below the point of discharge; so far as putrefaction is concerned, it is necessary to have a dilution of at least 2.5 to 3 cubic feet per second per thousand population connected to the sewerage system," and Mr. Stearns' opinion (Mass State Board of Health, 1890) "that a dilution of 2.5 cubic feet per second per thousand persons was the least permissible, and that under certain conditions it might be necessary to have 7 cubic feet in order to guard against offensiveness." LEONARD P. KINNICUTT.

The Water Supply of New Orleans and Its Improvement. BY R. S. WESTON. *Public Health*, **28**, 278–287.—An account of the investigation of the author made at the Water Purification Station, at Audubon Park, New Orleans. The conclusions reached were "that the present water-supply of New Orleans is neither satisfactory nor abundant, and that sufficient data has been collected during the investigation to allow a system of water purification to be designed which will efficiently and economically purifiy the Mississippi River at New Orleans. Furthermore, the available evidence shows that the American system is best adapted to local conditions on account of its low first cost, coupled with adequate efficiency." LEONARD P. KINNICUTT.

Inefficiency of Ferrous Sulphate as an Antiseptic and Germicide. BY ALLAN J. MCLAUGHLIN, Hygienic Laboratory, Marine-Hospital Service, *Bulletin No. 15*.—The author quotes the opinions of various experimenters regarding the antiseptic and germicidal properties of ferrous sulphate, and gives the results of numerous experiments he has made in his study of the question. As a result of his experiments he states:

"Sulphate of iron does not show any restraining influence over the development of putrefactive changes unless it constitutes more than 2 per cent. of the mixture. It does not permanently restrain the development of putrefactive changes unless it constitutes at least 5 per cent. of the mixture.

As a germicide it has little or no action, even when applied under the most favorable conditions for disinfection. Where the material to be disinfected was flooded with the agent in saturated

solution, in nearly all experiments, its action was not apparent, and it failed to disinfect, under such favorable conditions, seven different varieties of pathogenic organisms out of nine, after an exposure of one hour to a saturated solution.

Tested upon feces, it failed to disinfect after three days, although intimately mixed with the feces, and when it was applied in saturated solution and in double the bulk of the material to be disinfected.

It seems, therefore, that copperas or sulphate of iron is of no real value as a disinfectant. The strongest solution has either no disinfectant action at all, or its disinfectant action is so slow and uncertain that its demonstration might be a matter of interest, but certainly could not be of practical value."

LEONARD P. KINNICUTT.

Notes on Formaldehyde. H. W. HILL AND B. R. RICKARDS. *Am. Public Health Ass., Vol. 28, p. 509–520.*—Formalin is the accepted name for a solution consisting of 40 per cent., by weight, of formaldehyde gas dissolved in water. Its specific gravity is approximately 1.077, and its boiling-point 95° C. On boiling, the formaldehyde gas escapes, and the temperature of the solution rises gradually to 100° C.; at the same time the solution becomes cloudy, owing to the formation of paraformaldehyde, and, if the distillation is carried far enough, the liquid residue on cooling yields a solid cake of paraformaldehyde. The amount of gas given off on boiling formalin increases as the temperature of the solution rises. At first the aqueous vapor contains about 25 per cent.; near the end of the distillation, 50 per cent. The amount of formaldehyde given off from a boiling solution, can therefore not be determined from the amount of liquid residue left in the flask. This difficulty in determining the amount of formaldehyde in experiments on bacteria, can be overcome if the formalin solution is converted into spray by means of a current of steam or air. By using steam under about 25 pounds pressure, formaldehyde can be passed into a room at the rate of 90 to 120 cc. per minute, the formaldehyde being projected as a fine mist, 20 feet, without perceptible deposit of moisture on the floor. Experiments showed that when formalin was used in the above way, only one ounce of formalin for every 1000 cubic feet of space was necessary to destroy diphtheria bacilli. These experiments were made in a specially constructed room or box and, although the rate of leakage and absorption of formalin in ordinary living rooms has not been determined, the authors consider it safe to say "that 5 ounces per 1000 feet, used as recommended, should hardly fail to make up for any loss occurring in a reasonably well-prepared room." LEONARD P. KINNICUTT.

Report of the American Public Health Association Committee on Standard Methods of Water Analyses. Third Report of Progress. *Public Health*, **28**, 388–396.—The committee

has, during the past year, given its attention chiefly to bacterial work, and especially to a comparative study of gelatine used in quantitative bacteriological work, and to comparative studies of unknown species. The committee finds that the gelatine medium, even when prepared according to the recommendations in their Second Report of Progress, fails to secure uniform results. Not only does the medium when so prepared vary in strength as shown by the specific gravity, but it varies greatly in reaction and melting-point. These different physical and chemical qualities effect its value for quantitative work to such an extent that when used to determine the number of bacteria in Brooklyn tap-water, the maximum number obtained was four times the minimum number. The average number of bacteria found upon the gelatine, melting above 25° C., was 105, upon gelatine melting below 25° C. 71. This is due to the rapid spreading of the liquefying colonies in the softer gelatine, with consequent obscuring of smaller colonies. The next important point appears to be the reaction; with gelatine melting at 25° C., the maximum number of bacteria is obtained when the acid reaction lies not far below 1.5 per cent., *i. e.*, such that 1.5 per cent. of normal sodium hydroxide is required to make the gelatine medium neutral to phenolphthalein. No relation between the count and strength of medium or the amount of salt could be observed, and it appeared probable that within limits the amount of nutrient material present is of less importance than the melting-point and reaction. The committee is now studying the physical characteristics of the gelatine medium as affected by sterilization and upon the change of reaction during sterilization.

The committee also calls attention to a modification of the standard methods in measuring the turbidity and color of water, *i. e.*, the modification of the wire method for measuring turbidity, and the glass disks for the determination of color, and endorse both these methods. These methods are described in circular No. 8, issued by the United States Geological Survey, and published by the Division of Hydrography, an abstract of which circular is to be found in this Journal, Vol. 9, p. 283.

LEONARD P. KINNICUTT.

A Study of the Methods Employed for Determining the Amount of Oxygen Consumed from Potassium Permanganate by the Impurities in Water and Sewage. BY H. C. FULLER. *Public Health*, **28**, 450–458.—This paper is little more than a description of the various methods in use for determining the "oxygen consumed" by the use of potassium permanganate. Numerous experiments were made with the different processes, but the data that were obtained were insufficient to draw any very definite conclusions. The Kubel, The Mass. State Board of Health, and the Water Analysis Committee of American Public Health Association Method gave fairly agreeing results, while Schulze's

method gave higher, and the English Official Method lower results than the three methods first named.

LEONARD P. KINNICUTT.

Report of Committee on Disposal of Refuse Materials. *Public Health*, **28**, 21-77.—The report of the committee, carrying out the plan of last year, of describing the methods used for the collection and disposal of refuse in the chief cities of America, consists this year of the following papers: "Refuse Disposal in Montreal," by Dr. Pelletier; "The Collection and Disposal of Garbage in Providence, R. I.," by Dr. Chapin; "The Disposal of Refuse in the City of Buffalo," by Professor Landreth; "The Disposal of Refuse Materials in Cincinnati, Ohio," by Dr. Stanton; "Disposal of Refuse of New York City," by Dr. Soper; "Street Hygiene in Vera Cruz and City of Mexico," by Dr. Iglesias. In Montreal, the final disposition is cremation, while in Buffalo and Cincinnati extraction processes are used. In Providence, which used an extraction process from 1890-1893, the garbage is now used for the feeding of swine. In New York the garbage of Manhattan and Brooklyn is taken by barges to Barren Island and extracted by New York Sanitary Sterilization Company. The garbage of the outlying boroughs of Richmond and Queens is destroyed by cremation. In Vera Cruz and in the City of Mexico, the garbage is carted out of the cities to special dumps.

LEONARD P. KINNICUTT.

Report of Committtee on "Dangers to the Public Health from Illuminating and Fuel Gas." BY S. H. DURGIN. *Public Health*, **28**, 132-139.—On account of the expense and time required, the committee was unable to make scientific tests as to just the physiological changes produced by long and short exposures to small amounts of the gas and to what extent the observed changes are continued or permanent. In place of this, they sent out circulars to 2,200 physicians asking for their personal experience in such cases. Replies were received from 460 physicians. Two hundred and forty-six reported no experience, the other 214 reported 1,025 acute cases of which 374 resulted fatally; 623 made complete recovery in periods varying from a few hours to three years, and 28 made partial recovery while under observation from three weeks to twenty-one months. Also 120 cases of chronic poisoning were reported as resulting from continued exposure to small amounts of gas from leaking fixtures. The committee then state that, in view of the well-known fact that illuminating gas contains from 7 to 30 per cent. of carbonic oxide, one of the most deadly poisons which could be liberated into an atmosphere for respiration, that in small quantities it may be tolerated or misapprehended by the sufferers for a sufficient length of time to produce headache, nausea, malaise, anæmia, dizziness, and a long list of concomitant symptoms, they recommend that gas-fitters and gas-fitters' materials be placed

under municipal control, and regulation as is now the case with plumbers and plumbers' materials in many of the cities of this country, and give as an example, the act passed by the Massachusetts State Legislature in 1897 regarding the licensing of gas-fitters; and the supervision of the business of gas-fitting for the City of Boston with a copy of the regulations made and in force in that city. LEONARD P. KINNICUTT.

Experiments in Disinfection with Formaldehyde Gas. BY M. P. RAVENEL AND S. H. GILLILAND. *Public Health*, **28**, 220–237.—The writers state that the experiments which form the subject of this paper were done on a practical basis in rooms and buildings not especially prepared for such experiments. They represent, then, conditions met with in actual work, and results which may be obtained in such work. Four methods were employed.

1. Generation of the gas from methyl alcohol by passing the alcohol vapor through platinized asbestos and five layers of 20-mesh copper wire.

2. Evolution of the gas from the commercial 40 per cent. solution by use of a retort without pressure.

3. Evolution of the gas from the commercial 40 per cent. solution, by evaporation from large surfaces.

4. A combination of the last two methods. The cultures used were, staphylococcus pyogenes aureus, typhoid, diphtheria, tuberculous sputum, anthrax, colon, hog cholera, spore anthrax, glanders and tubercle bacilli, and the twenty different experiments are fully described with the exact results obtained. The conclusion drawn from these experiments are as follows:

1. Formaldehyde is justly entitled to the high position which has been given to it as a disinfectant.

2. Special apparatus, while useful and convenient, is not absolutely necessary for the successful application of the gas

3. The germicidal power of formaldehyde gas is dependent on certain factors which are as yet imperfectly understood. Other things being equal, moisture and temperature are the most important of these factors.

4. In practice, every operation should be controlled by cultural experiments, and no room which has been exposed to infection should be considered as disinfected unless control cultures exposed in various parts of said room are shown to have been destroyed. LEONARD P. KINNICUTT.

Some Sandstone Waters of Great Purity. BY E. H. S. BAILEY. *Trans. Kansas Acad. Sci.*, **18**, 68–69.—Soft waters are uncommon in Kansas, but some are found even in the central portion. The amount of solid matter is given for a number of these, also the analysis of the water of the California spring near Ottawa, carrying 0.1051 gram per liter of salts.

W. F. HILLEBRAND.

AGRICULTURAL CHEMISTRY.

The Amounts of Readily Water-Soluble Salts Found in Soils under Field Conditions. BY F. H. KING. *Science*, 18, pp. 343–345.—By drying the soil sample at 110° to 120° C., as for moisture determinations, it was found possible to obtain 68.85 per cent. more NO_3, 62.38 per cent. more HCO_3, 62.42 per cent. more HPO_4, 244.32 per cent. more SO_4, 287.9 per cent. more SiO_2, 54.15 per cent. more Ca, and 109.03 per cent. more Mg readily soluble in water than from the fresh field sample. The chief cause for this difference is assigned to the physical conditions produced by drying. To illustrate the work being done in the Bureau of Soils, a table is given showing the amounts of readily water-soluble salts to a depth of 4 feet in a Wisconsin loam soil, unfertilized and also fertilized in different ways. The following table gives the data for the untreated soil, the figures representing parts per million of dry soil.

READILY WATER-SOLUBLE SALTS IN JANESVILLE LOAM.

	Surface foot.	Second foot.	Third foot.	Fourth foot.
K	28.72	48.80	13.36	27.84.
Ca	138.00	96.00	56.25	53.00
Mg	42.28	34.24	33.94	33.28
NO_3	36.32	46.88	45.44	42.72
HPO_4	37.60	18.40	29.40	17.20
SO_4	222.50	178.00	215.00	195.00
HCO_3	6,.00	6.00	6.00	12.00
Cl	2.00	2.00	2.00	2.00
SiO_2	35.11	68.14	36.28	26.38

H. W. LAWSON.

The Artesian Waters of South Dakota. BY J. H. SHEPARD. *S. Dak. Agr. Expt. Sta. Bull. No. 81*, pp. 43–62.—Analyses of 30 samples of artesian waters, made for the purpose of determining their fitness for domestic use and irrigation purposes, are reported and the effects of the different salts found in them upon the human system and upon soils and plants are discussed at considerable length. H. W. LAWSON.

Progress of the Beet-Sugar Industry in the United States in 1902. *U. S. Dept. Agr. Rep. No. 74*, pp. 221.—The report of the special agent, C. F. Saylor, shows a steady progress in this industry. At present, there are 55 factories in the United States capable of producing a total of 328,104 tons of sugar per annum. Twenty-one of the factories are located in Michigan. The total amount of sugar produced in 1902 was 218,405.85 tons. California led with a production of 79,271.79 tons, followed by Michigan with a production of 52,589.91 tons. The author reviews the history of beet-sugar production in the United States and discusses the feeding-value of sugar-beet pulp and many other ques-

tions of general interest in connection with this industry. Articles on beet seed and insect enemies of sugar-beets are also included in this publication. H. W. LAWSON.

Rennet Enzyme as a Factor in Cheese Ripening. BY L. L. VAN SLYKE, H. A. HARDING AND E. B. HART. *N. Y. (State) Agr. Expt. Sta. Bull. No. 333*, pp. 65–96.—The agencies believed to take part in the normal ripening of cheese are acids, enzymes in the milk, an enzyme in the rennet extract, and bacteria. The object of the work reported in this bulletin was to study the proteolytic action of the rennet enzyme as far apart as possible from the other agencies mentioned. The enzymes present in the milk were destroyed by heating to 85° to 98° C. Bacterial growth was prevented by the addition of 3 to 5 per cent. of chloroform by volume. The power of prompt coagulation by rennet was restored to the heated milk by the addition of calcium chloride or carbon dioxide. The experiments were planned to show the action of rennet enzyme in cheese-ripening in the presence and absence of acid and also with and without salt; the action of rennet extracts of different ages and of commercial pepsin on casein; the action of rennet extract in cheese and on paracasein dilactate in comparison with commercial pepsin; and the action of rennet extract in cheese containing bacteria. "In the case of every experiment made, there was little or no digesting action by either rennet enzyme or commercial pepsin in the absence of acid, while the action was marked in the presence of acid. In the absence of acid in cheese, no paracasein lactate is found and little or no proteolysis occurs; in the presence of acid in the cheese, paracasein monolactate is formed and digestion takes place, the rennet ferment being the active agent. The ability of rennet enzyme to convert paracasein into soluble nitrogen compounds appears to depend upon the presence of acid, resulting in the formation of paracasein monolactate. Rennet enzyme and commercial pepsin act essentially alike in forming soluble nitrogen compounds, when compared with each other in the case of cheese, milk and paracasein dilactate. In the case of both rennet enzyme and commercial pepsin, the chemical work performed by the ferments is confined mainly to the formation of the paranuclein, caseoses and peptones, while only small amounts of amides are formed, and no ammonia. Rennet enzyme is really a peptic ferment. Salt, in the proportions found in normal cheese, appears to have little effect upon the action of rennet enzyme in cheese-ripening. The experiments on this point are, however, not regarded as conclusive. The abnormal conditions present in many of the experiments, such as pasteurized milk, calcium chloride and chloroform, would tend, if they had any effect at all, to decrease the digestive action of rennet enzyme. Our results, therefore, may properly be regarded as representing the minimum effect of rennet enzyme

in cheese-ripening. The digestive action of rennet enzyme does not appear to extend to the formation of compounds that produce the flavor of cheese." H. W. LAWSON.

Arsenical Insecticides. BY G. E. COLBY. *Cal. Agr. Expt. Sta. Bull. No. 151*, 38 pp.—Analyses are given of 128 samples of Paris green. Of the 91 samples examined after the taking effect of the State law fixing a maximum permissible content of free arsenious oxide at 4 per cent. and a minimum of total arsenious oxide at 50 per cent., 45 samples were found objectionable. Methods of examination are discussed, the author concluding "that the examination of Paris green, both as regards the physical and chemical tests, is not as obscure a matter as was formerly claimed by some chemists." Of the commercial substitutes for Paris green examined, such as paragrene, gray arsenoid, etc., few were passable as regards free water-soluble arsenious oxide. Paragrene contained 19.31 per cent. of calcium sulphate. Laurel green contained 50 per cent. of calcium sulphate and 20.2 per cent. of calcareous sand. White arsenoid contained 27.64 per cent. of free arsenious oxide. Farmers are warned against the indiscriminate use of these substitutes. The author recommends the extensive trial of home-made arsenicals (compounds of lead and arsenic and of lime and arsenic), especially the lead compounds when large quantities are required. Directions for the preparation of these arsenicals are given.

H. W. LAWSON.

PATENTS.

APRIL 7, 1903.

724,416. Edward H. Amet, Waukegan, Ill. Assignor to Stereopticon and Film Exchange, Chicago, Ill. **Heating gas.** Acetylene 28, oxygen 33, and nitrogen 17 parts.

724,477. Carl Hitzl, Brooklyn, N. Y. **Crystallization.** A heavy sugar syrup is made with additions of alcohol and flavoring matters, and the mixture introduced into a heated bottle which is gradually turned over so as to cause the liquid to coat every part of the inside, on which it crystallizes.

724,503. Edward C. Rice and Henry F. Monk, Cripple Creek, Colo. **Solder for aluminum.** Mercurous chloride 19, magnesium chloride 15, zinc 12, and cadmium nine and one half parts.

724,553. Charles E. Davis, Chicago, Ill. **Preserving food.** A continuous current of electrolyzed air is caused to play on the food in a closed chamber, while the gases of said air are in a nascent state. They may be combined with the vapors of fused oil, turpentine, etc.

724,565. Albert Frank, Charlottenburg, and Herman Freudenberg, Frankfort-on-Main, Germany. Assignors to Cyanid Gesellschaft, M. B. H. A **fertilizer** containing lime and a cyanamide, the latter yielding up its nitrogen in the soil.

724,616. James A. Sackville, Manchester, England. **Leather cloth**. Viscose is mixed with filling and coloring-matter and the mixture padded on to a fabric which is then washed and dried.

724,631. Ernst Voetter, Uerdingen, Germany. The process of **dyeing with sulphur dyes.** The edges of the goods to be dyed are kept constantly wet and cool by applying a cold liquid whereby the tendering of the edges is prevented.

724,636. Theobald Wendling, New York, N. Y. Assignor to Carl Bomeisler and Henry Fisher, same place. **Filtering substance.** Disintegrates asbestos fiber by treating it with a carbonate and then with an acid till effervescence ceases, washing the fiber and adding magnesium silicate to form a paste with which asbestos cloth is impregnated and coated, then baked for about an hour at 300° C. and finally washed.

724,637. Wm. C. Wetherill, Canon City, Colo. Assignor to Empire Zinc Co., Denver, Colo. Sufficient iron is added to **zinc ore** to make the ore capable of magnetic separation, then reducing and distilling off the zinc by excess of carbon in a closed retort, thereby producing a carbonaceous residuum adapted for magnetic separation by its iron content, crushing this residuum, separating the magnetic portion by magnetism, and further separating the coal from the residuum by a rough wet concentration.

724,743. Carl Schirmacher, Soden, Germany. Assignor to Farbwerke, vor. Meister, Lucius und Bruning, Hochst-on-Main, Germany. **Red azo dye.** Diazotized *p*-nitraniline monosulphonic acid is combined with β-naphthol. A red powder of bronzy luster, soluble in hot water yellow-red, less easily in cold water, in concentrated sulphuric acid blue-red.

724,764. Henry Wasbers, York, Pa. Making **explosives.** The powder dust arising from the manufacture of black powder is mixed with nitronaphthalene, and to this mixture is added nitroglycerine.

724,788. Guido Blenio, New York, N. Y. **Fire-proofing fabrics.** The fabric is soaked in an aqueous solution of alum and ammonium phosphate, and then in a solution of liquid glass.

724,789. Rene Bohn, Mannheim, Germany. Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-am-Rhein, Germany. **Blue dye.** A mixture of β-aminoanthraquinone, caustic potash and ammonium nitrate is fused, the melt dissolved in water, the dye precipitated by oxidation and separated from another more soluble dye by crystallization. The dye is crystalline, indigo-colored, insoluble in water, caustic soda and mineral

acids; one constituent is difficultly soluble in aniline, quinoline and nitrobenzene, the other is readily soluble in these reagents, and in the reduced form the former is blue the latter brown-red.

724,810. Axel V. F. H. F. C. Clauson-Kaas, Copenhagen, Denmark. **Elastic albuminate.** Albuminates are made flexible by mixing aluminum hydroxide with them, together with glue and a saccharate.

724,882. Victor D. Karavodine, Paris, France. **Insulating material.** Resin or oils are combined with powdered sulphur and non-active material, heated to 350° to 400° C. with agitation, cooled, ground and compressed at 350° to 400° C., and a pressure of 100 to 300 kilograms per square centimeter.

724,893. August L. Laska, Offenbach-on-Main. Assignor to K. Oehler, Anilin and Anilin Farben Fabrik, same place. **Violet azo dye.** A tetrazotized *p*-diamine is combined with 2 molecules of the glycine of an aminonaphtholsulphonic acid, the dye being a black-brown powder, soluble in cold water violet, that becomes redder on adding soda-lye and separates a black-violet precipitate with hydrochloric acid, dissolving pure blue in concentrated sulphuric acid.

724,894. As above, but in place of the first component are used intermediate products from *p*-diamines and oxycarboxylic acids of the benzene series, forming a brown powder that dissolves in water red, turning brown with soda-lye and precipitates brown flakes with hydrochloric acid, dyeing fast red shades on unmordanted cotton.

724,932. Francis I. DuPont, Wilmington, Del. **Purifying nitrocellulose.** Submerges the material in water under pressure, agitates it violently with great changes of pressure, whereby the impurities are loosened and washed out. The apparatus is a cylinder with conical bottom with pipe and pump connecting the top and bottom to produce circulation.

725,002. James E. Miller, Monroeton, Pa. **Composition for removing varnish.** Alcohol 3, amyl acetate 2, acetone and butyric ether, each 1 part.

725,016. Charles H. Stearns of Westminster, and Frank T. Woodley, Plumstead, England. **Filaments and films** from cellulose. Cellulose xanthate is dissolved in an alkaline solution, allowed to stand awhile, then precipitated by acid or a compound that will liberate an acid, and formed into films or filaments and passed through an acid-bath or a bath that will liberate an acid.

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725,071. Frederick E. Gore, Yarmouth, Me. Assignor to S. D. Warren Co., Boston, Mass. **Cooking cellulose fiber.** The fiber is digested with caustic soda liquor, diluted with spent soda liquor, afterwards transferring the dilute liquor from the

fiber to reactive contact with calcium hydroxide, then returning the liquor to the fiber, thus maintaining the efficiency of the soda liquor.

725,094. Winfield M. Kimberlin, Akron, Ohio. Assignor to Goodyear Tire and Rubber Co., same place. **Cementing substances.** The surfaces to be united are roughened, then coated with a cement whose solvent is a solvent of caoutchouc or gutta percha, as naphtha, etc., treating the cemented surfaces with a curing solution, as sulphur chloride, and pressing the surfaces together.

725,161. Albert W. Smith, Cleveland, Ohio. **Extracting bromine.** A bromine-laden gas is brought in contact with potassium carbonate and the resultant gases acted on by an alkaline earth hydroxide.

725,257. Thomas B. Joseph, Mercur, Utah. **Gold extraction.** The ore is subjected to an aqueous mixture of potassium cyanide, bromine, calcium hydroxide, and carbon dioxide, and agitated by compressed air, the precious metals being subsequently precipitated.

725,297. Hermann G. C. Thofern, Paris, France. **Treating matte.** A hearth furnace is surrounded by tuyeres that deliver a blast of mixed air and steam on the surface of the matte, said blast carrying with it granulated fluxes, oxidizing agents, and hydrocarbons.

725,352. Edward J. McAleer, Sharpsville, Pa. **Purifying gases** from metallurgical furnaces. A tall shaft, down which the gases are drawn into a cistern of water with a conical bottom and draw off.

725,356. Joseph H. Osgood, Peabody, Mass. **Printers' ink roller.** Coats the ordinary rollers with formaldehyde and alcohol to make them tougher and more durable.

725,361. Ferdinand E. Polzeniusz, Frankfort-on-Main, Germany. **Nitrogen compounds.** Makes nitrogen compounds containing 20 per cent. of nitrogen by heating calcium carbide and calcium chloride in an atmosphere of nitrogen. Among the compounds are calcium cyanamide and cyanides.

725,363. Nathaniel B. Powter, Brooklyn, N. Y. Treating **oil shale, fish material,** etc. Assignor to the Powter Co., New Jersey. Heats the material under a vacuum and also in the presence of a dry compressed gas, removing and collecting the oil separated during the second step, and adding water to the residue to dissolve glue, etc., then drying the residue.

725,370. Margaret Schmitz, Tipton, Mo. **Coating yeast** to preserve it. Corn starch 1, table salt 9, flour 28, and water 32 parts.

725,427. Oscar H. Eliel, Lasalle, Ill. **Sulphuric acid apparatus.** A denitrating and concentrating tower with a closed top, a sulphur burner, and a flue from the burner into the tower above the filling, and a spray nozzle and water supply over the filling.

725,467. Theodor Meyeringh, Grand Rapids, Mich. Assignor one-half to George T. Johns, same place. Compound for **cleaning sinks.** Hydrochloric acid 32, indigo sulphate and water 1 part each.

725,501. Francis M. Spence, David D. Spence, and Thomas J. I. Craig, Manchester, and John J. Hood, London, England. Assignors to Peter Spence and Son, Manchester, England. **Sodium bichromate.** Carbon dioxide is passed into a solution of sodium monochromate and ammonia till half of the sodium is precipitated as sodium bicarbonate and at the same time half the chromic acid has combined with the ammonia, separating the sodium bicarbonate, boiling the solution of sodium chromate and ammonia to drive off the ammonia, and concentrating the solution of sodium bichromate.

725,520. Frederick C. Weber, Chicago, Ill. **Reducing metallic oxides** with aluminum. Dries the mixture of aluminum and metallic oxide before reduction, they being in a fine powder.

725,533. Max Arndt. Apparatus for **analyzing gases.** The combination of gas suction and delivery apparatus with gas absorption apparatus arranged to receive gas from said suction apparatus, and automatic means for operating by air pressure.

725,542. Graham Clarke, Cleveland, Ohio. Assignor to the Lennix Chemical Co., same place. Apparatus for **administering gas.** A gas cylinder, a yoke and pipe coil connected thereto, said coil immersed in a hot-water cup and a support for the mixer. Two gases may be used, as nitrous oxide and nitrogen.

725,548. Henry R. Ellis, Salt Lake City, Utah. **Extracting copper.** Ores containing copper carbonate or oxide are treated with sodium carbonate and potassium carbonate in aqueous solution as solvents of the copper.

725,553. Daniel W. Gill, Cheyenne, Wyoming. **Cleaning soda.** Dissolves natural soda in water at 160° F., dropping the temperature and keeping it at 140° till the impurities have settled out, and drawing off the solution and recrystallizing at about 50° F.

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725 648. Otto P. Amend, New York, N. Y. **Tanning.** Hides are treated with a solution of a nitrite of chromium, iron, etc., and an ordinary organic tanning liquor.

725,683. Charles A. Doremus. **Alumina.** Aluminous material is treated with an acid containing fluorine, and the resulting fluoride subjected to superheated steam.

725,786. Wm. Smethurst, Dolgelly, England. **Treating substances with nascent carbon dioxide.** A combustible carbon gas and its equivalent of air are mixed and burned under pressure in a solution of calcium borate, and the boracic acid recovered by decanting while warm.

725,816. Johann H. J. Bartels, Waterloo, near Liverpool, England. **Cement for wood.** Animal glue, 9 parts, dissolved in weak lime water, fine linseed meal 2, and sodium silicate 1 part.

725,823. Carlos Casanovas Y. Amat, Barcelona, Spain. **Perforated patterns in fabrics.** The outline of the pattern is traced with a substance which destroys the fabric where it touches, thus making the pattern. May be an acid or acid salt for vegetable fiber, an alkali for animal.

725,847. Myrtil Kahn, Elberfeld, Germany. Assignor to Farbenfabriken Elberfeld Co., New York, N. Y. Process of **dyeing.** Diazo derivatives of *o*-amino phenol and 1-5-dihydroxynaphthalene are combined and the product dyed on wool from an acid bath and then treated with chrome salts reacting as oxidizers to make a fast black.

725,848. As above for **black azo dye.** Nitro-ortho-amino-phenol-mono-sulphonic acids and 1-5 dihydroxynaphthalene react to form brown-black powders, soluble in water violet, in concentrated sulphuric acid of 66° Beaumé green-black turning violet-red by the addition of ice, giving a reddish brown precipitate, and dying wool from acid baths deep violet, changing to black on chroming.

725,864. Wm. B. McPherson, Los Angeles, Cal. Apparatus for **treating gold and silver ore.** Tanks with conical bottoms are arranged to hold the cyanide solutions, and provided with vertical electric conducting plates, a precipitating tank, and suitable pipes to cause the solution to circulate throughout the apparatus.

725,879. John Schmidting, Vienna, Austria-Hungary. Making **cliches** in high relief. A sensitized gelatine film is printed and acted on by an alcoholic solution of silver nitrate, dried and treated with hydrogen sulphide, then swollen with water, electroplated and the gelatine removed; a cast taken and a printing surface of celluloid made from the cast.

725,890. Karl Stephan, Berlin, Germany, Assignor to Chemische Fabrik auf Action, vorm. E. Schering, Berlin, Germany. **Camphene.** A hydrogen-haloid compound of pinene is heated with an aqueous solution of a base and an alkaline salt of the higher fatty acids as soap, and isolating the camphene thus formed.

725,895. Manual V. Uslar, Gros Lichterfeld, near Berlin, and Georg Erlwein, Schoneberg, near Berlin, Germany, Assignors to Siemens and Halske, Aktien Gesellschaft, Berlin, Germany. **Extracting gold.** The ore is lixiviated with a solution of potassium cyanide, rhodanides, hyposulphites, and sodium chloride.

725,896. Gerhard N. Nis, Schweitzerhalle, near Basle, Switzerland. **Purifying brine.** Adds magnesium carbonate to change all calcium compounds to calcium carbonate, separates and concentrates the brine, removes the sodium chloride from the motherlye, which is mixed with slaked lime, the precipitate washed and treated with CO_2, and the regenerated magnesium carbonate again used on fresh brine.

725,968. Oliver T. Hungerford, Brooklyn, N. Y. **Plastic compound for insulators.** A silicious base, as sand, talc, or kaolin, 8 parts, a resinous binder, as asphalt and rosin oil, 1 part each. May add zinc oxide, etc.

725,993. Ernest C. Sachse, St. Louis, Mo. **Fire kindler.**

725,998. Ernst A. Sjostedt and Joseph H. James, Sault Ste Marie, Canada. Assignors to Francis Hector Clergue, same place. **Separating copper and nickel.** The ore is concentrated, crushed and desulphurized, treated with boiling dilute sulphuric acid, cooled and diluted so as to just hold all salts in solution, electrolyzing with a current of 0.3 ampere per 100 sq. cm. of cathode surface, while agitated with an air current till most of the copper has been deposited and the deposit begins to darken, then running off the solution to treat fresh ore and repeating the electrolysis as often as profitable, finally neutralizing the solution with caustic soda and making it ammoniacal, oxidizing the iron by an air blast, filtering off the precipitated ferric hydroxide and electrolyzing out the nickel with nickel cathodes and graphitized carbon anodes and a current of 0.6 to 0.9 amperes per 100 sq. cm. of cathode surface at a temperature of 80° to 90° C. while agitated by an air current.

726,029. Alexander Classen, Aix-la-Chapelle, Germany. **Pressed wood.** The comminuted wood is wet with sulphuric acid till the particles cohere under pressure ; it is then washed, dried and compressed.

726,036. Viggo Drewson, New York, and Lauritz J. Dorinfeldt, Tronhjelm, Norway. **Utilizing sulphite lyes.** Neutralizes sulphite mill liquor with soda pulp mill liquor containing sodium sulphide, concentrating and calcining the mixture, leaching the residuum and treating it with burnt lime and draining off the soluble sodium salts for re-use.

726,065. Henri Iscovesco, Paris, France. Assignor to Société Francaise pour la conservation des Beurres, Boulogne, Seine,

France. **Refining butter.** It is fused instantaneously at 35° C. in a vacuum of 70 cm. of mercury, mixing the molten butter with sterilized water and centrifugating it under the same vacuum, the time of melting not exceeding one minute, whereby the aroma is preserved.

726,076. Max Le Blanc, Carlsruhe, and Constantin Krauss, Hochst-on-Main, Germany. Assignors to Farbwerke, vorm Meister Lucius und Bruning, same place. Making **sulphuric anhydride.** Gases containing about 7 per cent. of sulphur dioxide and 9 per cent. of oxygen are sent through a first portion of contact substance at 500° C., and about 120 liters burner gases per kilo platinized asbestos, and directly conducting the resultant mixture through a second contact mass at 400° C. at the same speed.

726,091. Charles A. McKerrow, Manchester, England. **Reviving hydrated silicates.** A hydrous silicate is steamed in a closed vessel which is externally heated till all organic compounds and sulphur compounds are decomposed, and then withdrawing the external heat but continuing the steam till cooled to 212° F.

726,102. John Roger, London, England, and Montague K. Bamber, Columbo, Ceylon. **Extract of tea.** The tea is extracted with hot water, and the infusion centrifugated hot, then the fluid is cooled and centrifugated cold, then concentrating the clear fluid, and repeating the operation, if it appears necessary.

726,126. Georg Wichmann and Heinrich Kippenberg, Berlin, Germany. Assignors to Chemische Fabrik auf Actien, vorm. E. Schering, Berlin, Germany. **Mercury salts of ethylene diamine bases.** Ethylene diamines are caused to act on mercury salts as a citrate, the product being separated from adhering liquid and washed ; it is soluble in water, does not corrode the skin, and is adapted for use in place of mercuric chloride.

726,130. Alfred Wohl, Charlottenburg, Germany. **Lead sucrate.** A quantity of lead bisucrate is added to an alkaline impure sugar solution, then lead oxide is added in quantity insufficient to combine with all the sugar present, allowing the sucrate to crystallize and gradually adding more lead oxide but always less than enough to take up the sugar not crystallized, and removing the crystallized bisucrate.

726,181. Willis L. Moore, Washington, D. C. **Cooling and purifying air.** Air is passed downwards through melting ice. The water of the melting ice is led on to a freezing-mixture of ice and a chemical, as sodium chloride, and the partially cooled and dried air is forced through pipes immersed in the freezing-mixture, always in a downward direction.

726,204. Ignaz Timar, Berlin, Germany. Assignor to Fritz Heilinger, Andernach, Germany. **Thermophoric mixture.** A

mixture of a thermophoric salt as sodium acetate, the seeds of sunflowers and of *Foenum Graecum*, which contain viscous substances, and a fat.

726,214. Joseph Camus, Grand Croix, France. **Discharging liquid carbon dioxide.** In a compressed gas container, a tap, and a discharge nozzle having a reentrant cone with sharp edges, the diameter of the nozzle being greater than that of the tap. Condensation or solidification of the issuing gas is prevented.

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726,230. Wm. J. Armbruster, St. Louis, Mo. **Making pigments.** Barium hydroxide is added to a soluble salt of zinc not a sulphate and then zinc sulphate is added, all in molecular proportions, and the precipitate is recovered. Zinc chloride may be used for the first salt of zinc.

726,278. Thomas K. Gaines, Burnet, Texas. **Artificial Stone.** Equal parts of sulphur and cement are mixed and molded under pressure, and then treated with alum, vinegar, gum, and zinc oxide, equal parts.

726,294. Frederick J. Hoyt, Chicago. **Extracting gold.** The pulverized ore is distributed thinly over a long open sluiceway, down which it is flowed by a chemical solution of potassium cyanide adapted to dissolve the ore, the solution is separated from the sludge and the gold precipitated.

726,304. Omar H. Jewell and Wm. M. Jewell, Chicago, Ill. **Filtering water.** A coagulant is added to the water and it is then passed through an insoluble carbonate as calcium carbonate, thence into a filter.

726,486–7. Jacob F. Wittemann, Brooklyn, N. Y. The first for **finishing beer,** the second for treating **fermentation gas.** The apparatus consists of a storage tank and gasometer with suitable pumps and pipes to connect with the beer receivers; the second is for a process of recovering fermentation gas which is forced into air-free refrigerated beer, discharging the liquid under refrigeration into a separator, and repeating the operation, storing and refrigerating the gas which is separated.

726,533. George E. Hipp, Buffalo, N. Y. Making **muriatic acid.** Niter cake is dissolved and an alkaline sulphide added to precipitate arsenic and selenium, the solution is then boiled to free it from H_2S, then boiling, clarifying and concentrating, and introducing into a furnace with 39.8 pounds of salt, finally thoroughly blending and calcining the same.

726,582. Edward P. Smith, Chattanooga, Tenn. Assignor two-thirds to Mark L. Morrison and George Schindler, same place. **Composition.** Sawdust 3, gelatine and glycerine 1 part each are mixed and coagulated by formaldehyde.

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MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

Platinum in the Rambler Mine, Wyoming. BY J. F. KEMP. Advance extra from *Mineral Resources of the United States, Calendar Year 1902*, pp. 11–16; figure, plate.—This paper, following the statistics of platinum for 1902, by J. Struthers, is the result of recent study at this now famous mine. Owing to scattered and imperfect outcrops, the geological relations are not known in detail, but the main features are as follows: "An ancient series of much crushed, granitic gneisses is associated with assured quartzites, and both are penetrated by intrusions of granite, diorite, and peridotite. The ore which has thus far been discovered is in the area of a typical diorite, and does not appear outside of it." The ore body, so far as exposed by the workings, "presents some interesting and exceptional features. The usual vein minerals of the gangue, such as quartz, calcite, etc., are lacking. Instead we have . . . the decomposition products of an eruptive dike in place." "Although it cannot be denied that uprising waters may have served to decompose the rock and impregnate it with ore, it would seem more likely that a great dike of diorite originally charged with sulphides of copper and iron and with minerals involving the platinum group of metals has suffered from atmospheric weathering. The presence of the sulphides has facilitated its extensive alteration, and the secondary minerals thus formed have descended and become precipitated so as to enrich the residual kaolins." Covellite has replaced the dark minerals of much of the diorite, and the feldspar has been changed to what appears to be kaolin. Chalcopyrite and chalcocite also occur, and opaline silica was observed in the midst of the kaolin in one place. From the sulphides have arisen blue and green carbonates of copper, cuprite, and much limonite.

W. F. HILLEBRAND.

Some of the Pyrites Deposits at Port-Au-Port, Newfoundland. BY C. A. MEISSNER. *J. Mining Soc. of Nova Scotia, VII*, 55–60; figure.—The writer describes the probable mode of formation of these deposits, which show in places a gossan through which runs a skeleton-work of yet undecomposed pyrite, while at lower levels masses and impregnations of the sulphide are found. There is also a sulphur-yellow mineral—probably a ferric sulphate. An analysis of the gossan and of the pyrite are given, but they show no striking peculiarities. W. F. HILLEBRAND.

Marl (Bog Lime) and Its Application to the Manufacture of Portland Cement. BY DAVID J. HALE AND OTHERS. *Geol. Survey Michigan, Vol. 8, Part III*, 339 pp.; numerous plates, figures, and a map.—Besides the papers covered by the next following abstract, this report has chapters on "The Use of Marl for Cement Manufacture," pp. 5–40; "Record of Field Work," pp. 103–147; "The Manufacture of Portland Cement from Marl," pp. 158–190; "The Development of Marl and Clay Properties for the Manufacture of Portland Cement," pp. 191–198, by B. B. Lathbury; "List of Localities and Mills," pp. 234–253, by A. C. Lane; and "Methods of and Comments on Testing Cement," pp. 354–386, by Richard L. Humphrey. Analyses are scattered through some of these papers. W. F. HILLEBRAND.

Theories of Origin of Bog-Lime or Marl. BY D. J. HALE; **A Contribution to the Natural History of Marl.** BY C. A. DAVIS; **Notes on the Origin of Michigan Bog-Limes.** BY A. C. LANE.—These papers form Chapters IV, V, and VIII of Vol. 8, Part III, *Michigan Geol. Survey*, noted just above. The first and second papers present the evidence favoring the formation of the fresh-water marls by the action of certain forms of plant life upon the calcium carbonate in the waters of the lakes of Michigan. The main difference in the views of the writers, according to A. C. Lane, is "that the former is more inclined to look to microscopic plants and to the abstraction of CO_2 by plant life generally as inducing a chemical precipitation favored by light and heat," than to the action of *Chara* alone. The theory of deposition through the influence of organic life is greatly strengthened by analyses which have shown that the lake waters are never so saturated that a purely chemical precipitation of calcium carbonate can occur. No evidence is offered as a basis for the statements in Mr. Davis's paper that it is the oxygen liberated by plant life which is directly instrumental in breaking up the calcium bicarbonate in the water, "the free oxygen possibly acting still farther to precipitate calcium mono-carbonate." On the above subjects see also this Journal **24**, R 7 and 8. Analyses of waters, marls, etc., accompany these papers, and there is in that by A. C. Lane an extended abstract with figures from the original of Treadwell

and Reuter's paper on the solubility of the bicarbonates of calcium and magnesium. W. F. HILLEBRAND.

Mineralogical Notes. BY W. P. HEADDEN. *Proc. Colo. Sci. Soc.*, 7, 141–150.—*Native Tellurium.* Analyses are given of several samples of native tellurium from the Valley Forge mine, Boulder County, Colorado, and the Goodhope mine, Gunnison County, Colorado. One of the specimens from Boulder County was nearly pure tellurium, as analysis showed: Te, 99.45; Fe, 0.11; Se, 0.40, the last value being perhaps high. Another specimen yielding a little gold was associated with quartz and pyrite. In another, the 5.22 per cent. of nickel is supposed to exist as melonite and the gold as calaverite. In still another, besides these minerals, the presence of coloradoite is assumed to account for 4.22 per cent. of mercury. And again, the chief component of a specimen is arsenopyrite, with smaller amounts of rickardite and tetradymite. *Tellurite.* In the tellurium specimens from Gunnison County, tellurite occurs, both amorphous and crystallized. Apparently the crystals are quadratic, with the forms 111 and 100. The color in mass is brownish yellow to light brown; individual crystals vary from colorless to brownish yellow. They were seen attached to quartz and other gangue matter. Analysis gave: Insoluble in HCl, 1.04; Bi_2O_3, trace; Fe_2O_3, 0.70; Te, 78.68; O (by difference), 19.58. The ratio Te : O is almost exactly 1 : 2. *Cuprodescloizite.* A specimen from near Nogales, Arizona, of specific gravity, 6.176, had the following composition: V_2O_5, 19.014; As_2O_5, 3.824; PbO, 52.954; CuO, 8.506; ZnO, 12.450; Fe_2O_3, 0.200; MnO, trace; H_2O, 2.650; insoluble, 0.350; total, 99.996; No Cl or P_2O_5.

W. F. HILLEBRAND.

The Mineral Resources of the Mount Wrangell District, Alaska. BY WALTER C. MENDENHALL AND FRANK C. SCHRADER. *U. S. Geol. Survey, Professional Paper No. 15*, 71 pp.; maps, plates, and figures.—In this report is assembled all the information now available concerning the mineral resources of this region. The only analyses are by E. T. Allen of two coals, from the Chistochina and the upper Chitistone Rivers respectively. The former is a typical lignite, but the latter "has some of the physical and chemical characteristics of cannel." Its composition is: Water, 1.65; vol. comb., 51.60; fixed carbon, 40.75; ash, 6.10; fuel ratio, 0.79+. The reports of great discoveries of platinum in the gravels of the Nadina River are believed on theoretical grounds to be unwarranted, a belief which careful search by the authors and tests in the laboratory of the survey confirm.

W. F. HILLEBRAND.

[Rock Phosphates of the Columbia Quadrangle, Tennessee.] In *Geologic Atlas of the U. S., Columbia Folio.* BY C. W. HAYES

AND E. O. ULRICH.—This quadrangle embraces the area lying between latitudes 35° 30′ and 36° and longitudes 87° and 87° 30′. The phosphate-bearing formations are five in number, four being Ordovician and the uppermost of Devonian age. The former owe their origin to the leaching of limestones which were formed in a shallow sea thickly inhabited by phosphorus-secreting forms of animal life. The less-soluble phosphatic material has thus been concentrated. The phosphate of the Devonian deposits is in part derived directly from animal life occupying the sea at the time of their formation, and in part from the waste of a preëxisting Ordovician phosphatic rock, and has not undergone the leaching which is characteristic of the Ordovician deposits.

W. F. HILLEBRAND.

Significance of the Occurrence of Minute Quantities of Metalliferous Minerals in Rocks. BY CHARLES R. KEYES. *Proc. Iowa Acad. Sci. for 1902, Vol. X*, pp. 99–103.—A paper criticizing "certain methods of inquiry which are commonly followed in attempting to determine the amounts of ore materials that rock masses are supposed to contain," but giving the barest references to the grounds for the author's objections.

W. F. HILLEBRAND.

Genesis of Certain Cherts. BY CHARLES R. KEYES. *Proc. Iowa Acad. Sci. for 1902, Vol. X*, pp. 103–105.—The author gives reasons for his belief that some, at least, of the cherts of the Lower Carboniferous of the Mississippi Valley are of secondary origin and were not formed contemporaneously with the formations in which they occur, as has been generally assumed. They are of recent date, formed under the same conditions as the ores of the region, by replacement of the limestone.

W. F. HILLEBRAND.

A Possible Origin for the Lignites of North Dakota. BY FRANK A. WILDER. *Proc. Iowa Acad. Sci. for 1902, Vol. X*, pp. 129–135.

W. F. HILLEBRAND.

Synthesis of Chalcocite and Its Genesis at Butte, Montana. BY HORACE V. WINCHELL. *Bull. Geol. Soc. Am., Vol. 14*, pp. 269–276.—Identical with a paper in the *Eng. and Min. J.*, **75**, 782, abstracted in this Journal, **25**, R 347.

W. F. HILLEBRAND.

Gems and Precious Stones of Mexico. BY G. F. KUNZ. *Trans. Am. Inst. Min. Eng.*, **32**, 55–93.

W. F. HILLEBRAND.

Structure of Ore-Bearing Veins in Mexico. BY EDWARD HALSE. *Trans. Am. Inst. Min. Eng.*, **32**, 285–302; figures.

W. F. HILLEBRAND.

Notes on the Potable Waters of Mexico. By Ellen H. Richards. *Trans. Am. Inst. Min. Eng.*, 32, 335–343.—As a result of a hasty examination of 32 waters collected during the trip of the American Institute of Mining Engineers to Mexico, in 1901, preliminary tests of which were made on the spot, it is concluded "that the Cordilleran Plateau of Mexico furnishes water containing approximately the same proportion of chlorine as other inland regions of North America, and that iso-chlors may be drawn after more determinations have been made." Mexico City, Ajusco, Thalpan, Cuernavaca, Pachuca, and San Luis Potosi furnish the only soft waters of the list. Magnesium and sulphates in quantity are of rare occurrence, comparatively.

W. F. Hillebrand.

The Geographical and Geological Distribution of the Mineral Deposits of Mexico. By José G. Aguilera. *Trans. Am. Inst. Min. Eng.*, 32, 497–520.—As published, the paper deals with only the geological distribution. W. F. Hillebrand.

Geological Relations of the Manganese Ore-Deposits of Georgia. By Thomas L. Watson. *Trans. Am. Inst. Min. Eng.* (Advance extra, Albany Meeting, February, 1903), 47 pp.; figures.—The manganese deposits of Georgia are confined to the crystalline and the paleozoic areas, which together constitute the northern part of the state. But it is only the paleozoic area, in the northwestern corner of the state, which contains workable deposits of ore, and here the Cartersville and Cave Spring districts have produced nearly the whole amount. The ore is found in residual clays, derived from decay of the Knox dolomite at Cave Spring and of the Weisner quartzite and Beaver limestone in the Cartersville district. The Cave Spring ores differ from those of Cartersville, further, in being intimately associated with cherty beds, and in being stratigraphically higher. The mode of occurrence is identical in both districts, being an irregular distribution in pockets or lenticular masses with veins and stringers cutting the clay, rarely in distinct beds, again as nodules or concretionary masses, and disseminated in small grains. Iron ores are closely associated with the manganese, and there is every gradation from high-grade manganese ore to a similar one of iron ore. Beauxite and barite are also associated, but less closely. The manganese minerals constituting the ore are the oxides only, chiefly psilomelene and pyrolusite. The author adopts Penrose's views (*Ann. Rep. Geol. Survey, Arkansas, 1890*, I, 539) as to the origin and mode of formation of the above manganese deposits. The source of the manganese was either the material which gave rise to the residual clays, or, preferably, the older crystalline rocks, such as border the paleozoic area on the east and south, and which are composed in part of manganese-bearing silicates.

The manganese deposits of the crystalline area are likewise

found in residual clays, but these are derived, not from limestones or quartzites, but from a great complex of crystalline-metamorphic rocks, in which manganese-bearing silicates are common constituents.

Accompanying the discussion of the geology of the paleozoic area are analyses of the Weisner quartzite, by the author, and of shales and ores taken from other publications. In composition the Cartersville ores "do not differ essentially from similar high-grade ores occurring elsewhere." W. F. HILLEBRAND.

Uses of Peat and Its Occurrence in New York State. BY HEINRICH RIES. *Twenty-first Ann. Rep. New York State Geologist,* 153–190; plates (From 55th Annual Report New York State Museum).—In spite of the fact that the analyses are nearly all taken from other works and represent material foreign to the state, the information offered is varied and of interest.

W. F. HILLEBRAND.

Molding Sand: Its Uses, Properties and Occurrence. BY EDWIN C. ECKEL. *Twenty-first Ann. Rep., New York State Geologist,* 191–196 (From 55th Annual Report New York Museum).—Twelve analyses of standard foreign molding sands appear, there being none available of American material.

W. F. HILLEBRAND.

On the Atlin Mining District, British Columbia. BY J. C. GWILLIM. *Ann. Rep. Geol. Survey, Canada,* 12, *1899, Report B,* 48 pp.; map, plates.

On the Topography and Geology of Great Bear Lake and of a Chain of Lakes and Streams Thence to Great Slave Lake. BY J. MACINTOSH BELL. *Ibid., Report C,* 36 pp.

On the Geology and Natural Resources of the Area Included in the Map of the City of Ottawa and Vicinity. BY R. W. ELLS. *Ibid., Report G,* 77 pp.; map, plate.

On the Iron Ore Deposits along the Kingston and Pembroke Railway in Eastern Ontario. BY ELFRIC DREW INGALL. *Ibid., Report I,* 91 pp.; maps.

On the Geology of Argenteuil, Ottawa and a Part of Pontiac Counties, Province of Quebec, and Portions of Carleton, Russell and Prescott Counties, Province of Ontario. BY R. W. ELLS. *Ibid., Report J.,* 143 pp.; map, plates.

On the Surface Geology Shown on the Fredericton and Andover Quarter-Sheet Map, New Brunswick. BY R. CHALMERS. *Ibid., Report M,* 41 pp.; maps.

Section of Mineral Statistics and Mining, Annual Report for 1901. BY ELFRIC DREW INGALL. *Ibid., Report S,* 144 pp.—

The subject-matter of the above reports does not lend itself to the preparation of satisfactory abstracts. Some of the reports include analyses of various kinds, most of which, together with numerous others, are brought together in Report R, which has long since received notice in this Review **24** R 384.

W. F. HILLEBRAND.

Notes on Certain Archaean Rocks of the Ottawa Valley. BY A. OSANN. *Ann. Rep. Geol. Survey, Canada*, **12**, *1899*, *Report O*, 84 pp.; plates and figures. After describing two gneisses (with analyses by Dr. M. Dittrich, of Heidelberg), of quite distinct types, from near Montebello and Lachute Station, respectively, the apatite occurrences are rather exhaustively considered. It is impossible to repeat all the author's conclusions, however, or to touch upon more than a few points of interest. The so-called "pyroxenite" masses accompanying the veins are genetically very different, and are mainly "altered gabbros and secondary fillings, which are connected with the formation of the apatite." The deposits of apatite in Quebec known to the author "are all of the same origin and younger than the associated gneisses. They are, accordingly, true veins which have been formed in the same way as all other ore veins." "An extraordinary resemblance exists between the Canadian apatite veins and those of southern Norway." . . . "without even the existence of the difference due to supposed absence of extensive scapolitization. The vein minerals are, so far as observed by the author, essentially pyroxene, phlogopite, apatite. calcite, in paragenetic order. They, as well as the less prominent minerals, are considered separately, some are discussed at length with the aid of former analyses, and a few are figured. The cause of the marked asterism observed in the Burgess phlogopite and also in that from the North Star, and other mines visited by the author receives attention. It is undoubtedly the same in both cases—delicate needles which are to be regarded as of primary and not secondary formation. Sandberger and Lacroix, by chemical tests seemed to show that the needles consisted of titanium oxide, but Professor Jannasch, working on 0.0466 grain, decided that they contained but little titanium and were essentially a mineral (not silicate) of the rare earths, zirconia being apparently one of these. Boron and fluorine could not be detected. Of eruptive rocks accompanying the apatite veins several are described, and of these two have been analyzed (Dittrich): Enstatite gabbro from the Emerald mine and shonkinite from the Crown Hill mine. There are also described: Altered plutonic rocks and "pyroxenites," consisting essentially of augite and scapolite; several crystalline schists, some of them very peculiar; eruptive rocks occurring near the apatite veins but unconnected with their formation; a mica-hypersthene-gabbro (analysis by Dittrich), the main rock of the hill at Côte St. Pierre from

which some of the earliest specimens of Eozoon were obtained. Finally, two Canadian occurrences of graphite have been studied, their vein contents and associated eruptives being described. These are at Graphite City, and near Grenville Station. The vein graphite is younger than the containing rocks. The apatite and graphite veins exhibit so much in common mineralogically and geologically that they must have had a similar or analogous origin. W. F. HILLEBRAND.

ANALYTICAL CHEMISTRY.

Soundness Tests of Portland Cement. Digest of an abstract in the *Engineering Record.* BY W. P. TAYLOR. *Eng. Record,* **48,** 184–188.—The most important cause of unsoundness in cements is free lime, which may be present from incorrect proportioning, underburning, lack of seasoning, or coarseness of grinding, which prevents perfect hydration.

Tests of soundness are ordinarily limited to normal and accelerated tests. The normal test in air and water is unquestionably the only perfectly fair method of determining the permanency of a cement, but in practice, the element of time is so important that an accelerated test, which is supposed to hasten expansive action and cause any possible failure of the material in a few hours, is imperative.

In making accelerated tests the form of the test piece has little or no influence on the result. The cement should be given time to develop a hard set and then it should be put into cold water which is gradually heated to the boiling-point and maintained at that temperature for three or four hours. Tests made in steam alone or in steam, followed by immersion in boiling water, may give rise to erroneous conclusions, especially if the specimens are tested soon after making.

Data compiled from over a thousand tests on many varieties of cements showed that 86 per cent. of the samples that failed in the boiling test gave evidence of possessing some injurious quality in less than one year. Of those cements that passed the boiling test but one-half of 1 per cent. showed signs of failure in the normal pat test and but 13 per cent. lost strength in a year's time.

A slow-setting cement that is high in lime may pass the boiling test, and yet check and disintegrate in the normal pat test, especially if the test is made soon after the specimen is molded.

The disintegrating action of a cement is always far greater when mixed neat than when mixed with an aggregate, and the greater the amount of the aggregate the less the tendency to unsoundness.

Accelerated tests of cements should not be made at the beginning of the testing operation, but should be deferred until the twenty-eight day briquettes are broken. B. S. CUSHMAN.

The Iodometric Determination of Gold in Dilute Solutions. By Ralph N. Maxon. *Am. J. Sci.*, 16, 155–160.—Small quantities of gold may be determined by estimating the iodine set free, under suitable conditions, by auric chloride, from potassium iodide, by careful bleaching with sodium thiosulphate and the final addition of standard iodine to the incipient coloration of the starch indicator.

A method announced by Rupp (*Ber. d. chem. Ges.*, 35, 2011) for the estimation of gold, depending on the precipitation of that element from auric chloride by means of standard arsenious acid in excess and the titration of the excess of arsenious acid by iodine was tried by the author and found to be entirely untrustworthy. B. S. Cushman.

A Method for Calibrating Burettes. By D. W. Horn and Elizabeth M. VanWagener. *Am. Chem. J.*, 30, 96–105.—For this method of calibration, two burettes having their tips joined by a piece of rubber tubing, are so mounted on a tall iron stand that one of them can be raised or lowered while the other remains stationary. Water is made to flow into the stationary burette by gradually raising the movable one and the calibration thus obtained can be duplicated by lowering the movable burette and allowing the water to flow back into it.

The following precautions are recommended:

Avoid the use of a float in the movable burette.

For joining the burettes use a piece of rubber tubing of such length that at least 20 cm. hangs vertically beneath each burette.

Arrange the apparatus so that the rubber tubing, during the calibration, does not come into contact with anything that might help to support its weight or alter its volume.

In making duplicate calibrations do not allow the walls of the burette that is almost empty to become dry. B. S. Cushman.

A Rapid Method for the Determination of Arsenic in Arsenopyrite. By J. L. Danziger and W. H. Buckhout. *School of Mines Quart.*, 24, 400–404.—The method, which was essentially that proposed by Williamson and described by Sutton, is carried out as follows: Mix half a gram of the finely ground ore with 10–15 grams of sodium peroxide in an iron crucible, cover the mixture with a layer of the peroxide and heat very gently until the mass sinters and the upper layer of peroxide becomes deep yellow. Increase the heat to bright redness and about five minutes after the mass becomes perfectly liquid complete the decomposition by holding the crucible over the flame and rotating the contents. A Bunsen burner gives all the heat required. After cooling, leach the fused mass with about 100 cc. of boiling water, boil vigorously to decompose the excess of sodium peroxide and manganates, cool, transfer to a 200 cc. graduated flask, dilute to the mark, mix thoroughly, allow to settle and decant through a dry filter-paper.

Acidify 100 cc. of the clear filtrate strongly with concentrated hydrochloric acid, concentrate to about 75 cc. to expel carbonic acid, add 75 cc. of concentrated hydrochloric acid, cool to room temperature and add 3 grams of potassium iodide (best as a saturated aqueous solution). Titrate the liberated iodine immediately with a standard sodium thiosulphate solution until the color of the solution is reduced to a very light yellow and finish the titration, using the drop test with starch solution on a white tile to determine the end-point.

Under these conditions of titration, a thiosulphate solution that has been standardized by copper, iodine or potassium dichromate will give too low results for arsenic, but this error can be almost exactly corrected by adding 1 per cent. of the standard in terms of arsenic to the calculated value. It is, however, better to standardize by the use of arsenic.

To remove antimony from the solution, add hydrochloric acid to the filtrate from the fusion until it is just distinctly acid, cool to room temperature, pass in a rapid stream of hydrogen sulphide until the antimony is completely precipitated, expel the hydrogen sulphide by a current of air (without heating), filter and wash with cold water. Oxidize the arsenic in the filtrate with potassium chlorate, boil to expel the chlorine, bring to standard conditions and titrate. B. S. CUSHMAN.

A Method for the Determination of Carbon in Carbides. BY F. A. J. FITZGERALD AND H. M. LOOMIS. *Electrochemical Industry*, 1, 410.—The following method has been used by the authors in the analysis of silicon carbide, titanium carbide, and similar compounds with satisfactory results:

Weigh from 0.2 to 0.5 gram of finely powdered carbide into a 30 cc. nickel crucible and add about 1 gram of calcined magnesia and a quantity of fresh sodium peroxide equal to 10 to 15 times the weight of carbon taken. Mix rapidly with a platinum rod, cover, and heat the crucible with a hydrogen flame. The reaction usually starts in twenty to thirty seconds and is complete in ten more. Cool the covered crucible in a desiccator charged with soda-lime, and then transfer it to a covered dish and extract the contents with warm water which has been recently boiled. After all effervescence ceases, transfer the solution to a flask and determine the carbon dioxide by any suitable method.

A blank test showed that practically no carbon dioxide was absorbed from the air during the analysis. B. S. CUSHMAN.

Tests of Portland Cement Mortar Exposed to Cold. BY C. S. GOWEN. *Eng. News*, 50, 98.—The following conclusions were drawn from a series of tests made for the purpose of getting some definite information as to the effect of frost on Portland cement mortar, under the different conditions in which it may be desired to use cement in cold weather.

A two-to-one mixture of a moderately quick setting cement can be used in temperatures of about 20° F. without freezing.

The use of a 10 per cent. brine solution delays freezing, at least, at temperatures of about 15° F., if it does not wholly prevent it before the set has occurred.

Freezing delays the action of setting, but does not reduce the ultimate strength of the mortar.

Under ordinary laboratory conditions, the use of brine temporarily delays setting, but does not materially affect the ultimate strength of the mortar. B. S. CUSHMAN.

A Quick Way of Preparing Rock Sections. BY G. L. MACKENZIE. *Eng. Min. J.*, September 5, 1903.—The thin splinter of rock is cemented by Canada Balsam to a glass support $1^1/_2$ inches square and $^1/_4$-inch thick. Two slabs of carborundum are taken, one fine, the other coarse, each 4 inches long, 1 inch wide by $^1/_4$-inch thick. The grinding is started on the coarse slab, using water only as a lubricant, and rubbing in circles; it is finished similarly on the fine slab. If extra polish is desired, a final rubbing can be given on a small piece of "Water of Ayr" stone. When as thick as note-paper, it is transferred to the final glass mounting-slip, and the other side finished down in similar manner. When thin enough, a cover-glass is cemented on. The whole time taken is about three-quarters of an hour, and the apparatus so simple as to be easily portable in the pocket.

J. W. RICHARDS.

A New Sulphur Method for Iron and Steel. BY E. J. ERICSON. *Iron Age*, August 27, 1903.—This is a modification of Carius' method for sulphur in organic compounds, and is recommended for making sulphur standards and check-work in general. Put 3 grams of borings or drillings into a hard, Bohemian-glass tube, like a combustion tube, sealed at one end, add 25 to 30 cc. of strong nitric acid and 5 cc. strong hydrochloric acid, draw the open end out to a capillary and seal. Cool and then heat on a water-bath two hours. Cool, break capillary, add 5 to 10 cc. dilute hydrochloric acid, boil five minutes, transfer to a porcelain casserole, neutralize with sodium carbonate, and proceed to the determination of sulphuric acid as barium sulphate, for which specific directions as followed by the author are given.

J. W. RICHARDS.

Methods of Analysis of Fluor-spar. BY E. J. ERICSON. *Iron Age*, August 27, 1903.—Decompose 0.5 gram in a large platinum crucible, with enough concentrated sulphuric acid to saturate the bases present, evaporate till white fumes cease, add 5 grams of sodium carbonate and fuse twenty to thirty minutes. Cool, transfer to a 5-inch porcelain dish, add 60 cc. dilute hydrochloric acid, evaporate twice to dryness and separate silica. By this

treatment, no silica is lost, as has been proved by numerous comparative analyses. The rest of the analysis is finished as usual. J. W. RICHARDS.

A New Method of Determining Titanium. BY E. J. ERICSON. *Iron Age*, August 27, 1903.—The idea is to precipitate by ammonium phosphate instead of sodium phosphate. Dissolve 0.3 to 0.5 gram of ferro-titanium in 15 cc. dilute nitro-sulphuric acid (equal parts), evaporate to fumes of sulphur trioxide, cool, add 15 cc. dilute hydrochloric acid, boil, filter, add enough sulphur dioxide or ammonium bisulphite to reduce the iron, heat to boiling, and add 25 cc. of a 10 per cent. solution of ammonium phosphate, boil twenty to thirty minutes, settle an hour, filter, and wash with hot water. Ignite strongly. The factor for reducing weight of precipitate to TiO_2 is 0.336, corresponding to $Ti_2P_2O_9$, as proved by many comparative analyses. J. W. RICHARDS.

INDUSTRIAL CHEMISTRY.

Liquid Fuel for Power Purposes. BY A. L. WILLISTON. *Eng. Mag.*, July–August, 1903.—The author concludes that one pound of oil is equivalent to 1.5 to 3 pounds of coal, according to the quality of the latter, and that a slightly higher efficiency, 4 to 6 per cent. may usually be expected from the oil, while the boiler capacity, or evaporation per square foot of heating surface, may be increased from 30 to 50 per cent., using oil, without lowering the efficiency. The saving in cost of firing varies from little or nothing in small plants to perhaps 75 per cent. in the largest, in the latter case being equivalent to a reduction of 20 cents per ton of coal burned in producing a given horse-power. The present production of petroleum is at the rate of 70,000,000 barrels yearly in the United States, of which about 80 per cent. is from Pennsylvania and Ohio and is comparatively unavailable for fuel purposes; the most promising fields for fuel oil are California and Texas. Oil firing can only be used where oil is cheap and coal dear. In New York City, for instance, with buckwheat coal at $2.85 per ton and oil at 3½ cents per gallon, delivered, oil-burning would be 69 per cent. the more costly; in California, New Orleans or Texas, with inferior coal costing $5.25 per ton and oil at 55 cents per barrel, delivered, oil-burning is 72 per cent. the cheaper. J. W. RICHARDS.

The Manufacture of Ethyl Alcohol from Wood. *Iron Age*, September 17, 1903.—The Lignum Inversion Company has established an experimental plant at Highland Park, near Chicago, to operate the patents of A. Classen. The plant has been operating eight months, three months under the supervision of Dr. J. H. Long, president of the American Chemical Society. Professor Long states that the process is simple in theory and operation,

the raw material is cheap and abundant, and the method is novel. The operation consists in: (1) Converting the cellulose into sugar in a lead-lined digester. The sawdust is moistened with one-third its weight of a 3 per cent. solution of SO_2, the temperature is raised to 145° C. by steam, and the digester revolved. After ninety minutes the sawdust has shrunken to a nearly dry, brown mass. Fully 85 per cent. of the SO_2 is recovered in the exhaust steam. (2) The contents are put into leaching tubs, in which the sugar is washed out. By ten washings, 450 to 500 pounds of sugar are obtained per ton of sawdust; 70 to 80 per cent. of this sugar is fermentable. (3) The sugar solution has its acid neutralized by carbonate of lime, then pumped into fermenting vats, heated to 30° C., yeast added, and in thirty minutes brisk fermentation begins, which is complete in eight to ten hours. (4) The fermented liquor is run to the distillery, equipped with ordinary stills and condensers. Experimental tests have given $24^1/_2$ to 27 gallons of absolute alcohol (49 to 54 proof gallons) from 2240 pounds of wood, at a cost of 13 cents per absolute gallon. On a larger scale it is expected to reduce this to 7 cents. After exhaustion, the residues may be pressed into briquettes by pressure alone, and charred in kilns, yielding wood alcohol, wood tar and acetic acid in normal quantity. The briquettes weigh 75 per cent. of the weight of sawdust used, and contain 80 per cent. carbon, 1.04 hydrogen, 0.32 nitrogen, 8.34 oxygen, 0.01 sulphur, 9.05 moisture, 0.47 ash. The charcoal is suitable for use in blast-furnaces. The commercial development of the process is now proceeding under the care of O. Sjostrom. J. W. RICHARDS.

METALLURGICAL CHEMISTRY AND ASSAYING.

The Making of Specifications. BY C. B. DUDLEY. *Iron Age*, July 9, 1903. (Presidential Address before the Am. Soc. for Testing Materials.)—A very fair review of the rights and obligations of sellers, purchasers and consumers of the materials of engineering. J. W. RICHARDS.

An Introduction to the Study of Alloys. BY H. M. HOWE. *Eng. Mag.*, August, 1903.—An outline of the science of alloys, condensed from advance sheets of the author's forthcoming volume "Iron, Steel and Other Alloys." The constituents of alloys are classed as either (1) pure metals, (2) definite chemical compounds, such as $AuAl_2$, SnSb, Fe_3C, or (3) solid solutions of metals in each other. Any given piece of alloy may at the same time contain substances of each of the three classes. A knowledge of the constitution of a series of alloys gives us a superior method of analysis of the problem of where to find in that series the most valuable alloys, for the critical points for constitution may be expected to be also critical points for the useful properties. A comparison is made

between the constituents of alloys and those of crystalline rocks. The outlines of metallography are stated in very clear, easily understood language. J. W. RICHARDS.

Magnesite for Furnace Linings. BY C. SCHNATTERBECK. *Eng. Min. J.*, July 11, 1903. (Advance sheets of *Mineral Industry.*)—The consumption in the United States is now 40,000 long tons annually; most of this is imported (duty-free) from Euboea and Styria. The crude material sells at New York at $5.50 to $6.00 per long ton, and contains approximately 94 per cent. magnesium carbonate, 4.40 calcium carbonate, 0.08 ferric oxide, 0.52 silica and 0.54 water. Calcined at a white heat, the water and carbonic acid are completely removed, and it then sells at $15.50 to $16.00 per long ton. Bricks made therefrom contain nearly 94 per cent. magnesia, 3.2 silica, 0.3 ferric oxide; they cost $155 per 1,000. Bricks made of a mixture of magnesite and chrome ore give satisfaction for some purposes. [Bricks chiseled out of solid magnesite are on the market, coming from Persia, and stand moderate heats very well.] J. W. RICHARDS.

The Utilization of Blast-furnace Gases for Power Purposes. BY C. KIRCHOFF. *J. Franklin Inst.*, August, 1903.—The Lackawanna Steel Company at Buffalo are putting in eight 1,000 horse-power and sixteen 2,000 horse-power engines, to use blast-furnace gas, at their new steel plant at Buffalo. There are probably 225,000 horse-power of gas-engines now operating or being built. There is an available surplus of 1,800,000 horse-power in the United States, if all our blast-furnaces were thus equipped, saving some $28,000,000 annually, which is now wasted. The surplus amounts to 800 horse-power per ton of pig iron made per hour. The highest efficiency test has been shown by a Koerting double-acting, two-cycle engine, *viz.*, 38 per cent. The dust must be removed from the gases before use; a question regarded as mastered in Europe, but not quite conquered in the United States, with its very fine ores to smelt. A full description of various gas-engines follows. For these large powers, engines with no exhaust valve, that is, two-cycle engines, are best. J. W. RICHARDS.

Machine-cast Sandless Pig Iron. BY E. S. COOK. *Iron Age*, July 9, 1903 (read before the American Society for Testing Materials).—Sand-cast pig iron varies in composition not only from cast to cast, but from one end of the cast to the other, and frequently from one pig to another. The running of a cast into a large ladle and thence into a casting machine, allows the sampling of the liquid pig iron in bulk, and has thus removed one of the chief bones of contention between the seller and purchaser. The pigs from one cast in the machine are also remarkably uniform, so that sampling of the machine-cast pig iron is much more reliable and satisfactory than that of sand-cast pigs. If the fur-

nace manager selects the casts which come within the specifications, he can furnish the foundry with a raw material as uniform as human fallibility will allow of. The physical appearance of the pigs thus cast is various, solid, porous, cracked, or broken by the strains of rapid cooling, but the composition in one cast is almost perfectly uniform. The writer's experience is that the cost of labor and maintenance of the machine is as great as with a sand bed. J. W. RICHARDS.

Method for Comparative Valuation of Ferro-silicons. BY G. T. DOUGHERTY. *Iron Age*, September 3, 1903.—Starting with Bessemer pig iron as a standard, the calculations are made that the silicon in ferro-silicons is paid for at the price of the alloy minus the value of the iron in it. On this basis, the following values are derived:

Per cent. silicon.	Price per gross ton.	Cost of contained silicon in cents per pound.
12	$ 30	4.0
25	$ 70	9.7
50	$125	10.1
75	$235	13.7

Carborundum to do the same work costs about 12 cents per net pound of silicon introduced into the steel. J. W. RICHARDS.

The Casting of Pipeless Ingots by the Sauveur Overflow Method. BY A. SAUVEUR AND J. WHITING. *Iron Age*, July 16, 1903 (read before the American Society for Testing Materials).—The aim of this method is to maintain the top of each ingot liquid until all the metal below has solidified, which is accomplished by so connecting a number of molds that the metal can overflow from one to the other, while pouring is continued in the first mold until all the rows are filled. Photographs are shown of six steel ingots of 1 per cent. carbon steel, cast in this manner, and the first two were absolutely pipeless, the third showed a trace of pipe and the sixth the ordinary piping. If the sixth had overflowed into a mold, it also could have been obtained sound. The connecting of the molds with each other is easily accomplished by special forms of molds fitting against each other with a connection left at the top. Experiments are being made to apply the method to Bessemer and open-hearth ingots.

J. W. RICHARDS.

Nickel Steel: Its Properties and Applications. BY A. L. COLBY. *Iron Age*, August 20, 1903 (read before the American Society for Testing Materials).—A review of the history of alloys of nickel and steel and their mechanical properties. The presence of 4 or 5 per cent. of nickel does not reduce the modulus of elasticity. The chief difference from plain carbon steel is its higher elastic limit, that is, a raising of the proportion of elastic limit to ultimate strength, and an increase in ductility, that is, an increase in elongation and even greater increase in contraction of

area at rupture. Compressive strength increases uniformly with increase of nickel up to 16 per cent. of nickel. A 3 per cent. nickel steel shows about 48 per cent. greater toughness and 45 per cent. greater stiffness than plain carbon steel—"stiffness" referring to the amount of deflection produced by a blow and "toughness" referring to the number of blows required to produce rupture. Nickel steel is free from brittleness, and shows up better than any other steel in bending tests. Nickel steel is tougher than carbon steel, but not harder; a very low carbon steel cannot be made hard by the mere addition of nickel; steel with 0.30 per cent. carbon and 4.50 nickel can be cut by a penknife. Torsion tests show great resistance; also wear and abrasion are small because of the toughness. Punching reduces the strength of nickel steel 15 to 20 per cent., but of ordinary mild steel 30 per cent. Nickel steel rivets show greater shearing strength; a $^3/_4$-inch nickel steel rivet can safely replace a $^{11}/_{16}$-inch common steel rivet. Nickel segregates but very slightly in large ingots. The article closes with a summary of the present applications of nickel steels.

J. W. RICHARDS.

Inspection of Steel Rails. BY R. JOB. *Iron Age*, July 16, 1903 (read before the American Society for Testing Materials).—The ordinary drop-test (2000 pounds falling 20 feet upon butts $4^1/_2$ feet long, placed 3 feet between supports) does not cause fracture of coarse-grained rails excepting when brittleness due to other causes is present. Since the wear is found in practice to increase with the size of the grain, it should be feasible to increase the severity of the drop-test so as to cause fracture if the grains exceed a certain size, and thus get indications of great value as to the service life of the rail. If a fractured surface appears coarse, its micro-structure will also be coarse; if the former appears fine, the latter may be either coarse or fine; when the latter is fine, the former will be also. If a rail has been finished too hot, the fracture generally appears coarse, but sometimes fine, but the micro-structure will always appear coarse; such a rail will wear badly. A large majority of the rails which wear poorly or fracture in service are found to have coarse micro-structure, or to show evidences of piping. To insure tough, well-wearing rails the temperature of the ingot or bloom should be such that with rapid rolling and without holding before or after the finishing passes or without artificial cooling after the last pass, the distance between the hot saws shall not exceed 6 inches for a 30-foot rail. Solidity can be insured by careful cropping of the ingots. Brittleness is guarded against by a drop-test of 23 feet for a 90-pound rail. The composition preferred is carbon 0.53 to 0.63, manganese 0.90 to 1.20, phosphorus below 0.07 and sulphur below 0.07.

J. W. RICHARDS.

Mammoth Malleable Annealing Ovens. *Iron Age*, July 9, 1903.—Description and drawings of two large ovens, each built to hold 99 pots at once. The hearths are 19 feet 3 inches by 22 feet 6 inches, and 8 feet 6 inches high in the center. The plant of which they are part is the largest malleable iron works in the world, having a capacity of 85 tons of castings daily.

J. W. RICHARDS.

Springs. BY W. METCALF. *Iron Age*, July 9, 1903 (read before the American Association for Testing Materials).—A description of the forging, shaping, hardening and tempering of springs. Concerning chemical composition, the difference in strength between tempered steels made by the Bessemer, open-hearth and crucible processes, all of practically the same chemical analysis, is to be ascribed to differences in the amounts of oxygen, hydrogen and nitrogen in the steels, of which oxygen is the chief culprit.

J. W. RICHARDS.

The Dressing of Castings. BY R. BUCHANAN. *Eng. Mag.*, May, 1903.—The tumbling barrel is of immense importance to the foundrymen, for it not only cleans the castings but, as Outerbridge has shown, increases their strength 10 to 15 per cent. by the molecular annealing action resulting from the repeated shocks, which relieves the castings of the casting strains. All tumbling barrels should have a fan blast or exhaust to remove the dust as it forms. The sand blast has been doubtfully successful, its disadvantage being that the body of the casting is worn away at the same rate as projecting roughness. Sulphuric and hydrofluoric acids are often used, dilute, as a bath for dipping castings, to dissolve silicates formed on the surface. Such treatment is advisable only when machining has to be done, to soften the surface; it is detrimental to the appearance, and sets up vigorous rusting. Abrasive wheels are of emery, corundum or carborundum. Comparative tests showed an emery wheel lasting eleven working days and dressing 19 tons of castings, a corundum wheel $27^1/_2$ working days and treating 46 tons of castings, and a carborundum wheel running 157 working days and treating 259 tons of castings. The latter wheels do not glaze. Fixed shafts are used for small work, and flexible shafts for large castings. Pneumatic chipping tools are not suited for chipping light fins; they are most successful on heavy castings. Each absorbs from $1^1/_2$ to 2 horse-power. Files are important tools, and where the foundry and machine shop are in close relations the former can easily use up the half-worn files from the latter. J. W. RICHARDS.

An Experimental Reverberatory Furnace. BY W. McA. JOHNSON. *Eng. Min. J.*, **18**, 1903.—Description of a small furnace 7 feet long by 2 feet 6 inches high, arranged to burn fuel oil, using a motor-driven fan. The roasting hearth is 18 inches

long by 12 inches wide, the fusion box of similar size. Two such furnaces, complete, with electric pyrometer, cost $400. They are very useful for all sorts of metallurgical experiments.

J. W. RICHARDS.

The Charcoal Iron Industry of the Upper Peninsula of Michigan. BY W. G. MATHER. *Eng. Min. J.*, September 19, 1903 (read before Lake Superior Mining Institute).—A historical sketch of the development of this industry. The state has vast forests of hard wood in close proximity to its iron ores. It takes 90 bushels of charcoal of 20 lbs. each to produce a ton of pig iron, requiring $2^1/_4$ cords of wood. The plant of the Pioneer Iron Company requires 650 cords of wood daily, requiring the services of 650 men in the woods, and the cutting of 16 acres of wood daily. To make good charcoal, the wood is seasoned in piles in the woods for one year, so that a supply of some 200,000 cords is always on hand. The writer thinks that this district will hold its own in iron production for the next ten years. The iron is used almost exclusively for castings. J. W. RICHARDS.

Advances in Electro-Metallurgy of Iron. BY M. RUTHENBERG. *Iron Age*, September 24, 1903 (read before the American Electrochemical Society).—Given a magnetic ore carrying gangue, sulphur and phosphorus in prohibitive quantity for making good steel economically, such ores find no market at blast-furnaces; but, such ores can often be crushed, magnetically concentrated, electrically smelted, and produce the best steel at a price which can compete with an ideally situated blast-furnace and steel plant. One ton of magnetic concentrates can be electrically sintered and heated with 250 kilowatt hours of electric energy. The size of the agglomerated product is under perfect control. The hot ore falls thence into a soaking pit, where reducing gas reduces it to the metallic state; it is then dropped into a bath of melted pig iron on the hearth of an open-hearth furnace, where the spongy reduced iron combines with the pig iron to produce steel. The temperature of the fritting operation (1200° C.), combined with absence of reducing agents, causes Fe_3O_4 to react on FeS_2, and thus to eliminate the bulk of the sulphur from the ore, by a reaction similar to those in familiar use in the metallurgy of lead and copper. J. W. RICHARDS.

Acid-Proof Castings. BY O. NAGEL. *Iron Age*, September 24, 1903.—During his work in different chemical industries, the writer has observed that pig iron of the following compositions was most resistant to attack by acids:

	Dark gray iron.	Light gray iron.	Mixed iron.
Silicon	3.5	1.5	0.7
Manganese	0.5	0.4	0.2 to 0.3
Phosphorus	0.2	0.2	0.2
Total carbon	3.8	3.5	3.5

The best all-round iron is made by mixing 2 parts of the dark gray, 1 part of the light gray, and 1 part of the mixed iron.

J. W. RICHARDS.

The Small Converter Process for the Manufacture of Steel Castings. BY A. SIMONSON. *Iron Age*, September 10, 1903 (read before the Philadelphia Foundrymen's Association).—The problem was to make genuine steel in small quantities, which could be employed in small foundries, could be shut down like a cupola without any expense, could be handled in small ladles like gray iron, and would not be prohibitory in cost. In all the small converters, the blast is directed through the side of the converter on the top or above the metal. The Tropenas process fills all the requirements satisfactorily. The converters have generally a capacity of 2 tons, and can make from 2 to 20 tons a day. The level of metal reaches just to the tuyere openings. The bath is agitated very little by the blast. The metal is melted in a cupola capable of furnishing 5 tons an hour. Blast at 3 pounds pressure is sufficient for the converter, and the blow lasts twenty-five to thirty-five minutes. Then manganese is added as cold ferro-manganese. The pieces are held in tongs, dipped in water and thrown into the bath. The water on the surface makes a small explosion as it strikes the slag, parting it, and the ferro-manganese passes through; otherwise it is liable to become enveloped in chilled slag and refuse to melt. For carbon and silicon, a carefully weighed quantity of melted cast-iron from the cupola supplying the converter is run in. The steel is at a very high temperature, about 1800° C. (3300° F.). The cost of the steel in the ladles is about 2 cents per pound. The best cast iron to work on is silicon 1.9 to 2.3, manganese 0.6 to 1.0, carbon 3.0 to 3.5, sulphur and phosphorus as low as possible. The steel weighs 12 to 15 per cent. less than the cast iron used. An ideal arrangement is to run a Tropenas converter along with an open-hearth plant, to make all the small castings, under 100 pounds in weight, which are ordered or are required around the works.

J. W. RICHARDS.

Manufacture of Sound Castings by Means of Thermit. BY J. B. NAU. *Iron Age*, September 10, 1903.—The thermit (mixture of powdered aluminum and metallic oxide) is enclosed in a thin, sheet-iron box, fastened to the end of a dry, clean iron rod, sufficiently long to plunge the box into the bath of melted pig iron in the ladle almost to the bottom, for a time long enough to ignite the mixture and let the reaction take place. If the operation be done properly, the heat of the reaction will increase the temperature of the bath, the strong agitation will bring up slag and dirt to the surface, and the reduced metal will be incorporated into the bath. For general foundry work, titanic oxide containing some iron oxide is used, thus incorporating titanium into the

iron. Ferro-titanium put into the ladle also purifies and strengthens cast-iron. A similar treatment of melted steel removes blowholes completely and improves the steel. J. W. RICHARDS.

Valuation of Dredging Ground at Oroville, Cal. BY N. B. KNOX. *Eng. Min. J.*, September 12, 1903 (read before Institute of Mining and Metallurgy).—The ground is divided into blocks of 5 to 10 acres, and a $6^1/_2$-inch hole drilled in the center of each block. The drillings are raised by a sand pump, discharged into a wooden trough 12 feet by 1 foot square, from which they run into the riddle of a rocker, where they are rocked in the ordinary manner, care being taken to save all the fine gold. After each pumping, corresponding to about each foot drilled, a clean-up is made, thus giving approximate data as to rich or lean streaks. After the last clean-up, all the gold dust is collected by mercury, the amalgam treated by nitric acid, the gold washed well with hot water, annealed and weighed. In calculating the value of the ground, every running foot of hole is calculated as 0.27 cubic foot, although calculation makes it 0.23 cubic foot. By making this allowance, the results agree with what are obtained by sinking shafts or dredging on a large scale. The cost of drilling is $2.50 per foot. The results are usually reliable, but sometimes far above the actual dredging value. The average gold contents of these lands is about 21 cents per cubic yard, total expense of dredging 7 cents, loss in tailings 1 cent, net profits 13 cents. A five-foot bucket dredge will handle 50,000 cubic yards a month.
J. W. RICHARDS.

Recent Roasting Methods at Butte. BY H. O. HOFMAN. *Eng. Min. J.*, July 25, 1903 (read before the American Association of Mining Engineers).—Heap roasting has been entirely abandoned, as also the use of long-hearth reverberatory furnaces. The most recent developments are successive modifications of the MacDougall furnace. The original furnace was used at Liverpool to burn pyrites for making sulphuric acid. It is circular, with hearths one above the other, provided with stirring arms, and would roast $3^1/_2$ tons of pyrites in twenty-four hours, or 0.02 ton per square foot of hearth. The Herreshoff roasters are 10 feet in diameter by 11 feet 6 inches high, with 5 arched-brick hearths, the top one of which acts as a drier, the second starts the roasting, on the third the ore roasts freely, on the fourth no sparks are seen, and on the fifth the ore is dark. With the stirring shaft making 50 revolutions per hour, 5 to 6 tons of wet concentrates are roasted per twenty-four hours from 35 down to 6 per cent. sulphur, being 0.015 ton per square foot of hearth area. The Evans-Klepetko furnace is built on the same general lines; it has 6 hearths, water-cooled shaft and arms, and is 18 feet high by 16 feet in diameter. The shaft makes 60 circuits per hour; 20 gallons of cooling water are required per minute, the overflow being at 80°

C. The furnaces stand on columns 12 feet high, and six furnaces form a battery, being placed 18 feet apart in one direction by 21 feet 3 inches in the other. Forty-eight furnaces are connected with one steel chimney 200 feet high and 23 feet 6 inches inside diameter. If the ore is too low in sulphur, below 28 per cent., to be self-burning, an auxiliary fireplace to each pair of furnaces, delivering flame to the fourth floor, furnishes additional heat. Roasting begins on the second or third hearth; the ore passes through in one and one-half hours. One furnace treats 40 tons of ore in twenty-four hours, or 0.042 ton per square foot of hearth surface, reducing sulphur from 35 to 7 per cent. Thirty men in one shift attend to 48 roasters. The cost of roasting in this last type is $0.35 per ton. J. W. RICHARDS.

Method of Concentrating at Anaconda. BY M. SCHWERIN. *Eng. Min. J.*, September 12, 1903.—The ores consist of pyrite, chalcopyrite, bornite, enargite, chalcocite and covellite, together with much quartz, in part or completely replacing the country granite. Two classes of ore are shipped from the mines (at Butte, 27 miles distant). The first-class ore goes directly to the blast-furnace, and the second class to the concentrator. The object of the concentration is to increase the copper and iron, and to decrease the silica of the crude ore; the small amount of zinc blende present is given no attention. Two products are made, fine and coarse concentrates; the former are roasted in MacDougall furnaces preliminary to smelting, the latter go directly to the blast-furnaces. The concentrating operations consist in passing the ore through Blake crushers, until it is all finer than $1^1/_4$ inch; it is then sieved and jigged. The coarse concentrates go to the concentrate bins. The finer concentrates are passed through crushing rolls and rejigged. The concentrates go to the fine concentrate bins, the tailings to the dump, the middlings are further treated. The latter are ground in Huntingdon mills to 1 millimeter and are then rejigged, the concentrates going to the bins and the slimes to the Wilfley concentrating tables, which give good satisfaction. J. W. RICHARDS.

Method of Concentrating at La Cananea. BY M. SCHWERIN. *Eng. Min. J.*, September 26, 1903.—The ores are crushed to one inch, passed over a $^5/_8$-inch trommel and the oversize returned to crushing rolls and re-sieved. The ore passing the $^5/_8$-inch sieve is graded on $^3/_8$ inch, $^1/_4$-inch and $^1/_8$ inch, each of which size is jigged and the fines run on to Wilfley tables, middlings from each table going back over the same table, while the slime goes to outdoor settling tanks. The arrangement of this mill, designed to treat 600 tons daily, is described as an excellent example of "how not to do it." The 4 jigs and 44 Wilfley tables are inadequate in capacity, the oversize from the $^5/_8$-inch sieves should be at once concentrated instead of crushed finer, thus making un-

necessarily great quantities of slimes. Only slimes should go on the tables, not any sizes which can be jigged. Every step of the concentrating process is condemned. J. W. RICHARDS.

Two Notable Concentrating Plants. BY G. A. BURR. *Eng. Min. J.*, September 12, 1903.—A description of the plants of the Montezuma Lead Company and the Minas Tecolotes y Anexas, in the Santa Barbara camp, District of Parral, Chihuahua, Mexico. Each has a capacity for treating 400 tons daily, and the ores in each are practically identical, *viz.*, silver, 250 grams per ton (60 per cent. associated with galena, 30 per cent. with pyrites, 5 per cent. with sphalerite and 5 per cent. with silicious gangue); gold, 3 to 6 grams (associated entirely with the pyrites); lead, 6 to 10 per cent. (as galena); zinc, 7 to 12 per cent. (as sphalerite); iron, 6 to 7 per cent. (as pyrites); copper, $^1/_2$ to 1 per cent. (as chalcopyrite); silica, 50 per cent. (quartz gangue). At the Montezuma plant, the ore is crushed in Blake crushers to $1^1/_4$ inches, reduced in Cornish rolls to $^1/_2$ inch or less, and sieved into three classes. These classes are passed through Hartz jigs, giving concentrates, tailings and middlings. They are dried, ground fine in Chilean mills and passed over Bartlett and Wilfley tables, which recover the gold in pyrites as concentrate, while sphalerite passes off as middlings. The middlings from the first jigs are mostly a zinc-iron material, and are roasted in a pipe-furnace to make the iron magnetic, and then the latter extracted by Wetherill separators, producing tailings with 51 per cent. of zinc, and heads with 45 to 50 per cent. of iron, carrying copper and gold. The zinc concentrates are shipped to Hamburg, Germany. The concentrates and magnetic iron product go to the smelters. At the other mine, the motive power is five 150 horse-power Otto gas-engines, using gas generated from wood in a Loomis-Pettibone gas plant. Practice has shown that only one-fourth as much wood is used, as if burnt under boilers for steam-power. The crushed ore is ground in rolls, sieved, passed over Bartlett tables and the middlings re-ground, classified and passed over Wilfley tables. No effort is made to recover zinc or iron from the middlings, and no slime tables are employed. The extraction in the concentrates is 65 to 70 per cent. of the value in the ore. J. W. RICHARDS.

The Gold-bearing Gravels of Alaska. BY J. D. MCGILLIVRAY. *Eng. Mag.*, July, 1903.—Author states that there are far larger areas of gold-bearing gravel, and as rich, on the Alaskan side than on the Canadian side of the boundary. The output from the Klondike the present season will be about $20,000,000. Most of the richest claims are worked out, and the mines now profitable are such as would not have paid to work at the costs existing three or four years ago. The gravels are usually very uniform in quality, and as a general thing of high grade. What is now

wanted above all things is assistance from the Federal Government either by indirect or direct taxation, to improve the means of transportation. This would give the United States control of nearly all the trade of the Canadian Yukon.

J. W. RICHARDS.

A Promising Gold Field, and Tests by Sampling. BY OCCASIONAL CORRESPONDENT. *Eng. Min. J.*, July 18, 1903.—The Trinchera deposits, in Costilla County, Col., contain immense beds of quartzite which can be quarried, and which contain \$3 to \$5 worth of gold and silver per ton. Mill tests give higher results than sampling and assaying, the latter showing only one-half to two-thirds of the former. The valuation of such ores accurately, by assaying is difficult. The very small amount of gold present is apt to be lost in the parting operation. The author recommends that the whole of the parting liquor be filtered, the filter washed, dried, and carefully burned, and the ashes cupelled with chemically pure lead. Unless these special precautions are taken, an ore which exists in large quantities and can be worked with large profit, may be reported as assaying too low to pay for treatment.

J. W. RICHARDS.

Cyaniding Sulpho-telluride Ores. BY P. ARGALL. *Eng. Min. J.*, July 11, 1903 (advance sheets of *Mineral Industry*).—Bromo-cyanide, BrCN, acts as a cyanogen liberator in the cyanide process, forming potassium bromide and setting free the cyanogen in the nascent state. The activity of the nascent cyanogen enables it to attack unroasted tellurides. The cost of bromo-cyanide is, however, \$1.00 to \$1.20 per ton of ore treated, and royalty about \$0.42 additional, and with these charges the author believes it will always be cheaper to roast and then leach by the ordinary process. J. W. RICHARDS.

Antidote for Cyanide Poisoning. BY C. J. MARTIN AND R. A. O'BRIEN. *Eng. Min. J.*, August 8, 1903 (from Proceedings of the Society of Chemical Industry of Victoria).—It is recommended that 30 cc. of a 23 per cent. solution of ferrous sulphate be kept in a hermetically sealed glass tube, also 30 cc. of 5 per cent. solution of caustic potash in a similar tube, and a packet of 2 grams of powdered magnesia. To administer, the two solutions are broken into a half pint of water, the magnesia is stirred in and the mixture taken. J. W. RICHARDS.

Volatilization of Metals as Chlorides. BY S. CROASDALE. *Eng. Min. J.*, August 29, 1903.—The paper deals with the volatilization during chloridizing roasting, during which it is commonly recognized that 2 to 25 per cent. of the silver present is lost and a larger proportion of the gold. The author, with F. C. Pohle and E. N. Hawkins, conducted a series of experiments in a muffle, with 50 to 100 grams of ore, with proper quan-

tities of salt and sulphur, at about 1000° C. *Gold.*—Using Cripple Creek ore, 20 to 80 mesh, containing 2.14 ounces gold per ton, adding 10 per cent. of salt and enough pyrites to make up 2.5 per cent. of sulphur, the volatilization was 55 per cent. in ten minutes, 84 per cent. in twenty minutes, 90 per cent. in thirty minutes and 96 per cent. in forty minutes. Excess of sulphur over 2.3 per cent. reduced the amount volatilized; with 10 per cent. of sulphur present, only 43.9 per cent. of the gold was volatilized. Excess of salt over 10 per cent. makes very little difference; a deficit reduces slightly the amount volatilized. The gold is volatilized as chloride, possibly as double chloride with sodium, but is collected as finely divided metallic gold in the flue dust or water. Experiments with various ores, containing up to 3.34 ounces of gold per ton, showed volatilization varying from 80 to 99.4 per cent. *Silver.*—A high volatilization of silver is best secured by using excess of air during roasting, high temperature and constant rabbling. Extra salt and presence of other metallic chlorides increase the volatilization. The ores should be crushed very fine. The presence of antimony seems to diminish the volatilization of silver. Tests on ten different ores, containing up to 234 ounces of silver per ton, showed volatilizations between 81 and 99 per cent. *Copper.*—Cuprous chloride is slowly volatile at a dull red heat; each 1 per cent. of copper present requires 0.5 per cent. sulphur and 2 per cent. salt to volatilize it, but a slight excess over these quantities is used. The time required in a laboratory test is two to three hours. Carbonates, oxides and silicates, as well as chalcopyrite, bornite and covellite are tractable. Cupriferous pyrites is first partially roasted, to reduce the sulphur, and then given the chloridizing roast; or it may first be roasted sweet and then the necessary sulphur added as iron pyrites. Chalcocite and antimonial ores leave more copper in the residue. Tests on 14 different copper ores containing 1.7 to 20.3 per cent. of copper, showed volatilizations of 85.9 to 100 per cent. of the copper present. *Lead.*—This volatilizes easily by roasting with enough salt and sulphur to form lead chloride and sodium sulphate. The fumes contain sulphate as well as chloride. *Zinc* seems to volatilize easily as chloride up to 40 or 50 per cent. and then to be non-volatilizable. The reason of this action is not known. *Bismuth* is easily and completely volatilized. *Arsenic*, occurring as sulphide, is easily volatilized. *Antimony* acts irregularly; a 40 per cent. ore was volatilized to 90.7 per cent., but a 25 per cent. complex ore lost only 25 per cent. *Iron and aluminum* showed signs of very slight volatilization. *Complex Ores.*—It was found that if a complex lead-zinc sulphide ore was roasted to the point where the remaining sulphur was only enough to form normal PbS, and then salt added and the volatilizing roast begun, that the lead, gold and silver could be practically all volatilized without removing much of the zinc.

The results on three ores showed volatilization of 100 per cent. of the gold, 78 to 98 per cent. of the silver, 99.6 to 100 per cent. of the lead, and 0.9 to 11.6 per cent. of the zinc. Sudbury nickel ore was treated in a similar way, with volatilization of 62.8 per cent. of the copper and 13 per cent. of the nickel. Complete tests, with analyses, of eleven complex ores, showed volatilizations of 89.3 to 100 per cent. of the gold, 87.8 to 100 per cent. of the silver, 100 per cent. of the lead, 91.4 to 100 per cent. of the copper (46.1 per cent. in an ore containing as much Sb as Cu). The materials were crushed to 20 to 60 mesh, the sulphur present is brought to 2 per cent., the salt is seldom less than 5 per cent. and for some ores reaches 20, the mixture is charged with the furnace at 750° to 850° C., no flue dust is formed, the ore swells up and then shrinks, and the operation is finished at 1000° to 1100° C. The residue is taken to the dump. A revolving cylinder furnace, on an angle, working continuously, was found best. The fumes are collected by passing them through successive layers of water supported on perforated diaphragms. Gold is recovered metallic, silver as chloride and lead mostly as sulphate. They are separated by a filter-press. The copper remains in solution as sulphate, and is recovered by scrap iron or electricity. J. W. RICHARDS.

Volatilization of Metallic Chlorides. BY H. A. MATHER. *Eng. Min. J.*, September 5, 1903.—Discusses the Pohle process, as described by Mr. S. Croasdale, in which gold, silver and copper are volatilized by chloridizing roasting at a high temperature. Gold volatilizes as AuCl, which on cooling, in the flues, splits into Au and $AuCl_3$. If copper is present, vapor of $AuCuCl_3$ forms, which does not dissociate until water is encountered. Low temperature favors the formation of these compound chlorides, the sublimation temperatures of which are lower than those of the simple chlorides entering into them. Complete sublimation of all the gold, silver and copper can be attained at 400° C., if proper sublimation methods are used, and under some conditions, not yet explained, partial sublimation may occur as low as 100° C. Chloridization is complete at 650° C., and it is not necessary to go higher to complete the volatilization of the chlorides if the right way is adopted. J. W. RICHARDS.

Copper Refining, Great Falls and Anaconda. BY H. O. HOFMAN. *Electrochemical Industry*, August, 1903 (read before the American Institute of Mining Engineers).—These two refineries treat similar anode copper by the multiple process, but with different conditions of power. The Great Falls works uses water-power, and works with a current density of 40 amperes per square foot of cathode; the Anaconda works uses steam-power and a current density of only 10 amperes. At the former, the electrolyte contains 170 grams of sulphuric acid and 42 grams of copper per liter; at the latter 150 grams of acid and 40 grams of

copper. Enough crude hydrochloric acid is added daily to bring the chlorine up to 0.04 gram per liter, thus precipitating any antimony in solution, as oxychloride. The voltages across each tank are, respectively, 0.6 and 0.3. At Great Falls, cathodes are replaced every two days, the ampere efficiency of deposition being 91 per cent.; at Anaconda, cathodes are removed only when the anodes are replaced, every thirty-seven days. The percentages of anode scrap are, respectively, 8 (working on converter anodes) and 7 (working on refined copper anodes). J. W. RICHARDS.

A Study of Alloys Suitable for Bearing Purposes. BY G. H. CLAMER. *J. Franklin Inst.*, July, 1903.—Only few metals are available for such alloys; they are of copper, tin, lead, zinc or antimony, as the basis, to which may be added other metals or metalloids in varying small proportions. The combinations in use to-day may be enumerated as:

White alloys.	Bronzes.
1. Pb-Sb.	1. Cu-Sn.
2. Pb-Sb-Sn.	2. Cu-Sn-Pb.
3. Sb-Sn.	3. Cu-Sn-Pb-Zn.
4. Sb-Sn-Cu.	4. Cn-Sn-Zn.
5. Sb-Sn-Cu-Pb.	5. Cu-Zn-Pb.
6. Zn-Sn-Cu.	
7. Zn-Sn-Sb.	
8. Zn-Su-Sb-Cn.	

The writer then considers these alloys under the headings of composition, structure, friction, temperature of running, wear on bearing, wear on journal, compressive strength, cost. A successful bearing alloy must consist of at least two structural constituents—one hard constituent to support the load, and one soft constituent to act as a plastic support for the harder grains. A hard, unyielding bearing is a theoretical delusion, much to be desired but impracticable of application. All things being equal, bronzes will run at a lower temperature than the white metals. Lead is the best wear-resisting metal known; increasing antimony in lead increases the hardness and the wear; 13 per cent. antimony is the best proportion. The addition of tin to this alloy gives greater strength. Genuine Babbitt metal contains 89.1 tin, 7.4 antimony and 3.7 copper. In this, the matrix is tin containing cuboidal crystals of tin with 10 per cent. antimony, and brittle rods of tin containing 10 per cent. of copper. If lead is added to this alloy, in but small proportions, it makes it harder, stiffer, more fusible, cheaper, and better in every way. Copper must contain less than 15 per cent. of tin to make good bearing metal; the introduction of lead to it is a decided advantage, the rate of wear decreasing as tin is decreased and lead increased, so that it is desirable to produce a copper-tin-lead alloy with as little tin and as much lead as possible. The Pennsylvania Railway uses copper 78, tin 7, lead 15, it appearing that that much tin is necessary to hold the lead alloyed with the

copper. The presence of $^1/_2$ to 1 per cent. of nickel, however, allows the tin to be reduced down to 5 per cent., while the lead may be increased to 30 per cent. This alloy is known as "Plastic Bronze," and contains copper 64, tin 5, lead 30, nickel 1. Very complete tables of the alloys heretofore used accompany this valuable paper. J. W. RICHARDS.

The Testing of Bearing Metals. BY G. H. CLAMER. *Iron Age*, July 9, 1903 (read before the American Society for Testing Materials).—The general conclusions arrived at are that the amount of wear, in practice, decreases with decrease of tin in a copper-tin or copper-tin-lead alloy; decreases with increase of lead in a copper-lead or copper-tin-lead alloy; increases with increase of zinc in a copper-tin-lead-zinc alloy, and increases with increase of antimony in a lead-antimony alloy. The wear also increases, the lower the compressive strength of the metal running in the bearing; that is, hard metals wear the journal less than soft ones. Soft bearing metals are preferable to hard ones, in actual practice, because they absorb grit and accommodate themselves to inequalities of abnormal pressure. Microscopically, a bearing metal should consist of two structural constituents, one hard to support the load and one soft to give it plastic support. In copper-tin-lead alloys, the copper-tin alloy furnishes the cellular skeleton and the lead is the chief constituent of the soft, intercellular material. A small amount of nickel in such an alloy, phosphorized, decreases segregation and enables it to hold uniformly more lead. J. W. RICHARDS.

The History of Babbitt Metal. *Metal Industry*, September, 1903.—A sketch of the life of Isaac Babbitt, and a verbation copy of his United States patent (1,252 of July 17, 1839), which is now out of print. The patent was for a method of using white metals as linings for bronze bearings, and the composition of the "Babbitt" metal was mentioned incidentally as an 'excellent compound' which he had prepared for this purpose, but was not claimed as any essential part of his invention.

J. W. RICHARDS.

Notes and Data of Interest to Zinc Mines. BY W. G. WARING. *Eng. Min. J.*, July 4, 1903.—*Valuation of Zinc Ores.*—In Missouri, the assay basis for concentrates is per unit (each 1 per cent. of zinc), 25 cents for 40 per cent. zinc, 50 cents for 60 per cent. zinc, and 53$^1/_8$ cents for 64 per cent. zinc. It therefore pays the miner to clean or concentrate his ore as high as possible. Ore with only 20 per cent. of zinc is unmarketable. The weight of concentrates per cubic foot is 128 to 139 pounds, for fine-grained, nearly pure blende. The minimum weight is for grains about $^1/_{25}$ inch in size; finer than this, the weight, increases. J. W. RICHARDS.

Magnetic Separation of Zinc Ores. BY S. W. OSGOOD. *Eng. Min. J.*, September 5, 1903.—Great progress has been made recently in this branch. The great problem has always been the treatment of the fines. In one case, 23.9 per cent. of the zinc in the ore was in material between 30 and 60 mesh, 3 per cent. in material between 60 and 80 mesh, 19 per cent. in material between 80 and 100 mesh, 13 per cent. in material between 100 and 150 mesh, and 23 per cent. between 150 and 250 mesh. As, however, the magnetic material gets finer, it is less susceptible to magnetic attraction, the amount unaffected by magnetism increasing from 6 per cent. at 80 mesh to 35 per cent. at 150 mesh. Repeated passes are necessary to save the large amount of zinc in this very fine material; three passes extracted, respectively, 9 per cent., 22 per cent., and 53 per cent. of the zinc contents; total, 84 per cent.

J. W. RICHARDS.

Electrolytic Lead Refining. BY A. G. BETTS. *Electrochemical Industry*, August, 1903 (read before the American Institute of Mining Engineers).—The electrolyte is lead-fluosilicate, $PbSiF_6$, $4H_2O$, which dissolves at 15° C. in 28 per cent. of its weight of water, making a sirupy solution of sp. gr. 2.38. Excess of hydrofluoric acid solution is added, the electric conductivity being mainly dependent on the free acid. The deposit is branching and porous unless a reducing action is given, which is accomplished by adding gelatine or glue to the solution. The Canadian Smelting Works, at Traill, B. C., has 28 tanks, each 86 by 30 inches, and 42 inches deep, each having 22 anodes of 26 x 33 inches and 23 cathodes of like size, of sheet lead $^1/_{16}$ inch thick. Each tank receives 4000 amperes, dropping 0.44 volt across the electrodes, and produces 750 pounds of refined lead daily. The anodes weigh 3 tons, and are run eight to ten days. The starting sheets are made by depositing $^1/_{16}$ inch of lead on paraffined steel sheets. Tin in the anodes dissolves with the lead; iron dissolves only slightly, probably due to it being present in the lead as matte; arsenic, antimony, bismuth, copper, gold and silver are undissolved. The tin can be removed from the refined lead by poling it. Only a small amount of iron and zinc accumulate in solution, so little that the electrolyte need not be purified from them oftener than once a year. Analyses of the materials showed, in one instance:

	Pb.	Cu.	Bi.	Ag.	Sb.	As.
Bullion	87.14	1.40	0.14	0.64	4.0	7.4
Lead	....	0.0010	0.0022	...	0.0017	trace
Slimes	10.3	9.3	0.52	4.7	25.32	44.58

Most of the traces of impurity in the refined lead came from the mechanical deposition on it of slime floating in the solution.

J. W. RICHARDS.

Coal and Coke Production in 1902. *Eng. Min. J.*, September 19, 1903 (statistics compiled for Vol. XI of the *Mineral Industry*).—Anthracite decreased 26 million tons from 1901, being 41,500,000 tons. This was owing to the coal strike in Pennsylvania. Bituminous coal increased 33 million tons over 1901, to 258,400,000 tons. The total was 299,800,000 short tons, an increase of over 2 per cent. over 1901. Of coke, 23 million tons were made, an increase of 2,300,000 tons over 1901. The average value per short ton, at the mines, was anthracite $2.00, bituminous coal $1.11, coke $2.25. J. W. RICHARDS.

Smelting of Tin Ore in the United States. *Iron and Mach. World*, July 18, 1903.—The International Tin Company has erected a plant at Bayonne, N. J., consisting of four reverberatory furnaces, each capable of treating two charges of seven tons of ore daily, or a total capacity of fifty tons. The organizers of the enterprise are credited with having made arrangements to treat tin-ore concentrates, imported from the Straits Settlements, being carried as ballast by returning Standard Oil Company steamers. The Federated Malay States government have check-mated the enterprise by imposing an export duty of $450 per ton on tin-ore. In 1902, 8,000,000 pounds of pig tin was imported into the United States, valued at over $23,000,000. J. W. RICHARDS.

Antimony. BY J. STRUTHERS. *Eng. Min. J.*, July 4, 1903 (advance sheets from *Mineral Resources of U. S.*).—There was produced in the United States, in 1902, 20,970,000 pounds of hard lead, containing 5,808,000 pounds of antimony. No pure antimony from native ores is made in the United States. The smelting plants at Chelsea, Staten Island, N. Y., and Chapman Smelting Co., San Francisco, treated 3,129,069 pounds of imported ores valued at $62,968. These ores were mostly from China and Japan. There was also imported 5,388,739 pounds of refined antimony, valued at $333,601. The total consumption of antimony in the United States in 1902 is calculated as 6,255 short tons. J. W. RICHARDS.

Bismuth. BY J. STRUTHERS. *Eng. Min. J.*, July 4, 1903 (*Mineral Resources of U. S.*).—The production of bismuth ore in the United States in 1902 was 37.5 tons, all obtained from the Ballard Mine, Col. The ore averages 8 to 27 per cent. bismuth, 3.5 to 22 ounces of gold and 3.5 ounces of silver per ton. The value of the ore is $8 to $11 per ton for each per cent. of bismuth, the gold and silver being also paid for. Imports into the United States in 1902 were 190,837 pounds of bismuth, valued at $213,704; the domestic supply is, therefore, far behind the demand.
J. W. RICHARDS.

Chromium and Chrome Ore in 1902. BY J. STRUTHERS AND H. FISHER. *Eng. Min. J.*, July 11, 1903 (advance sheets from *Min-*

eral Industry).—During 1902, the chrome ore mines in California furnished 315 long tons of chrome ore, valued at $4,725. The standard ore is 50 per cent. Cr_2O_3, valued at $15 per ton, with about $1 per ton extra for each extra per cent. of Cr_2O_3. The Wilson Aluminum Company at Holcomb's Rock, Va., produced 1,200 tons of ferro-chromium in 1902. Most of the chromium ore used in this country is imported from Turkey. The Pennsylvania Railroad is experimenting with rails for heavy service containing 0.75 to 1.00 per cent. of chromium; the alloy used in their manufacture contains 50 per cent. chromium and 7 per cent. titanium. J. W. RICHARDS.

Production of Tungsten, Molybdenum, Uranium and Vanadium in 1902. BY J. H. PRATT. *Iron Age*, August 13, 1903 (from annual report of United States Geological Survey).—*Tungsten.*—There was produced 183.5 tons of crude ore. When concentrated to 60 or 65 per cent. tungstic oxide it is valued at $2.50 to $3.00 per unit per ton. The larger part came from Colorado, a small part from Connecticut. The Great Western Exploration and Reduction Co., of Boulder, Col., sell the material as concentrated ore and as ferro-alloy. *Molybdenum.*—The American Molybdenum Co., at Cooper, Washington Co., Me., have erected a mill to concentrate the ore, and expect to ship commercial molybdenite in 1903. The whole production in 1902 was 12 tons, from the mine of the Crown Point Mining Co., of Seattle, Wash. The value is $100 to $200 per ton for 50 to 55 per cent. ore. *Uranium and Vanadium.*—Extensive development work has been done by A. B. Frenzel on the deposits at La Salle Creek, southwest of Paradox, Montrose Co., Col. There was produced 3810 tons of crude ore, valued at $12.63 per ton. The concentrated uranium ore is valued at $320 per ton. The crude vanadium ore (3000 tons) contained 2.5 to 4 per cent. of vanadium oxide, the crude uranium ore (800 tons), 2.5 to 5 per cent. of uranium oxide, principally as carnotite. The demand has largely increased for these metals for production of ferro-uranium and ferro-vanadium and the manufacture of their salts. J. W. RICHARDS.

Production of Aluminum in 1902. BY J. STRUTHERS. *Iron Age*, July 16, 1903 (from *Mineral Resources of U. S.*, 1902).—The production in America was 7,300,000 pounds, produced by the Pittsburg Reduction Company, which has 11,000 H. P. at Niagara Falls, 5,000 at Shawinegan Falls, Quebec, and is installing a 12,000 horse-power plant at Massena, N. Y., and enlarging the capacity of its Niagara Falls (lower) plant by 3,000 horsepower. The present output of this company is greater than that of the four other companies manufacturing in Europe.

J. W. RICHARDS.

The Light Aluminum Alloys. BY J. W. RICHARDS. *Iron Age*, August 12, 1903 (read before the American Society for Testing

Materials).—Deals with the methods of alloying the metals together, the casting and working, and the mechanical properties of these alloys. The metals used should be as pure as they can be obtained commercially, to get the best results. Alloys with 2 to 3 per cent. of titanium have been made, but their use abandoned; chromium, tungsten and copper all make practicable alloys. The alloy with 2 to 10 per cent. of magnesium is very promising, but is handicapped by the cost of the magnesium. Several patented alloys contain small amounts of several metals, such as copper, tin, antimony and tungsten, copper, nickel and manganese. The alloys with up to 33 per cent. of pure zinc have valuable mechanical properties when properly made from pure metals, while the low cost of zinc make them the cheapest of the light aluminum alloys. J. W. RICHARDS.

A New Form of Crucible. *Metal Industry*, April, 1903.—Describes a crucible made by the Dixon Crucible Company which will find excellent use for white metal and brass and bronze founding. The crucible is of the ordinary shape with the exception of a partition or screen near to the front side and extending nearly to the bottom of the crucible. This acts as a skimmer, allowing metal to be poured only from the bottom of the crucible, and completely preventing slag or flux from entering the mold.

J. W. RICHARDS.

Casting of Manganese Bronze. *Metal Industry*, September, 1903.—If treated like ordinary brass, poor results always follow. It should be cast in dry sand. It should be melted in crucibles, kept covered with charcoal from the beginning, and not allowed to get too hot or to burn. It should be poured as hot as possible, being thoroughly skimmed beforehand. The zinc will flare freely during pouring. A skim-gate, or one of Dixon's new partitioned crucibles should be used, to keep dross, slag or charcoal from entering the mold. Runners should be as few as possible, and large, entering the casting from the bottom; a runner entering the top of the mold is sure to make dross in the casting. Large risers or feeders must be used on the heavy portions to supply shrinkage, with thick necks, which will not set too soon. The riser should have twice the diameter of the part it feeds. All working surfaces should be cast downwards. Each remelting oxidizes out $1^1/_2$ per cent. of zinc in crucibles, and 4 per cent. in reverberatory furnaces. J. W. RICHARDS.

Forging Aluminum Bronze. BY E. S. SPERRY. *Metal Industry*, April, 1903.—This alloy is the most satisfactory copper alloy known, for hot working. Unlike brass, it does not become brittle or black-short when redness disappears. It resembles closely pure copper. It is somewhat hard at a black or low-red heat, and if worked too hard at this heat will crack. In hot roll-

ing, the billet should be heated slowly to as near the melting-point as possible; by doing so, the occasional difficulty of cracking during the roughing or breaking down pass is obviated, and the metal is finished hot enough to avoid difficulty at the other end. The same treatment is to be recommended in rolling copper. If rolled too cold, small cracks appear on the surface. Bronzes with less than 7 per cent. of aluminum are soft enough for cold rolling; where strength with toughness is desired, 9 per cent. is recommended; for general purposes the 10 per cent. alloy is used, and is most suitable for forgings; the 12 per cent. bronze rolls well, but is very hard, with no elongation. J. W. RICHARDS.

A New Method of Improving German Silver. *Metal Industry*, April, 1903.—The usual grade used in the manufacture of flat-ware contains 62 per cent. copper, 18 per cent. nickel and 20 per cent. zinc; it tarnishes readily because of the large amount of copper. The new treatment, of Mr. T. B. Lashar, of Bridgeport, Conn., consists in dissolving away copper and zinc from the surface layer, by appropriate solvents, and then burnishing down the surface layer of pure nickel remaining, giving the article the hard, non-corrosive surface of pure nickel. J. W. RICHARDS.

Kayserzinn. BY E. S. SPERRY. *Metal Industry*, September, 1903.—This metal is an alloy made in Berlin and cast into artistic ornaments. It has been recently imported in large quantity into this country. Analysis of the alloy recently purchased gave 92.98 per cent. tin, 5.44 antimony, 1.58 copper, no lead and no silver. The composition is therefore almost exactly the same as is used for Britannia metal. The articles are sold at an unwarrantedly high price, so that the attractiveness of the designs is really responsible for the success of the sale of these ornaments.

J. W. RICHARDS.

Electrode Voltage or Electrode Potential. BY W. MCA. JOHNSON. *Electrochemical Industry*, July, 1902.—An explanation in easily understood language of the separate electrode potentials during electrolysis, and applications to the storage battery, electrolysis of dilute sulphuric acid, and electrolysis of copper and nickel salts, showing the cause of the different behavior of these two metals. J. W. RICHARDS.

The Legalized Standard of Electromotive Force. BY H. S. CARHART. *Electrochemical Industry*, August, 1903 (read before the American Institute of Electrical Engineers).—Carhart and Guthe's determination of the electromotive force of the Clark cell is 1.4333 volts at 15°. A comparison with the Weston cell showed the ratio 1.4067, to an accuracy of 0.01 per cent. It is proposed to discuss at the International Electrical Congress in St. Louis, 1904, the question of making the Weston cell the standard.

J. W. RICHARDS.

ORGANIC CHEMISTRY.

Calcium Carbide as a Dehydrating Agent for Alcohols. BY ALFRED N. COOK AND ARTHUR L. HAINES. *Proc. Iowa Acad. Sci.*, 9, 86–90 (1901).—The experiments conducted by the authors indicate that methyl, ethyl, butyl and amyl alcohols can be completely dehydrated by the action of calcium carbide. The progress of the dehydration was ascertained by determining the specific gravity of the alcohol at 15.5° before and after the treatment with carbide. M. T. BOGERT.

***p*-Oxy-*m*-Methylacetophenone and Some of Its Derivatives.** BY J. G. GOODWIN. *Proc. Iowa Acad. Sci.*, 9, 113–119 (1901).—In the preparation of *p*-hydroxy-*m*-methylacetophenone by the method of Nencki and Stoeber, the use of carbon tetrachloride as solvent instead of carbon bisulphide considerably increases the yield. The melting-point of the pure substance is 106°, and it gives no color reactions with ferric chloride or with caustic soda. Its solubility in water at 22° is 0.035 per cent.; at 70°, 2.76 per cent. Its *methyl ether* melts to a colorless oil at 25°, while the *ethyl ether* is a white solid, m. p. 34.5°. M. T. BOGERT.

Certain Derivatives of Trichlorethylidene-Di-*p*-Nitrophenamine. BY ALVIN S. WHEELER, AND M. R. GLENN. *Jour. Elisha Mitchell Sci. Soc.*, 19, part 2, 63–66 (1903). Trichlorethylidene-di-*p*-nitrophenamine is obtained by the condensation of chloral with *p*-nitraniline, and is a yellow, insoluble, crystalline powder, melting with decomposition at 216°. It is attacked by zinc dust and acetic acid, but the nature of the product has not as yet been fully worked out. Alcoholic potash changes the trichlorethylidene body to *dichlorhydroxylethylidene-di-p-nitrophenamine*, $CCl_2(OH)CH(NHC_6H_4NO_2)_2$; yellow prisms (from alcohol), turning brown in the air, m. p. 177°–178° (uncorr.); soluble in boiling water, in methyl or ethyl alcohols, ether, hot chloroform, hot benzene, or cold acetone, soluble in 75 parts boiling alcohol, but only difficultly soluble in cold absolute alcohol. If sodium methylate be used instead of alcoholic potash, the product is *dichlormethoxyethylidene-di-p-nitrophenamine*, light-yellow, rectangular plates, m. p. 176°–177°. By the action of a glacial acetic solution of bromine upon the trichlorethylidene compound a *bromine derivative*, melting at 202°–203°, is obtained, the character of which has not yet been determined. M. T. BOGERT.

On the Electrolytic Preparation of Iodoform from Acetone. By HOWE ABBOTT. *J. Phys. Chem.*, 7, 84–91 (1903).—After a systematic study of the subject, the author finds that the most favorable conditions for the preparation of iodoform from acetone by electrolysis are as follows: (1) A current density of not more than 1.35 amperes per square decimeter; (2) a temperature of

75° C.; (3) an anode solution containing 6 grams sodium carbonate, 10 grams KI, 100 cc. water, and 5.5 cc. acetone added at the rate of 0.5 cc. every ten minutes during the electrolysis. The yield of iodoform is much larger than that secured by Elbs and Herz, who used alcohol instead of acetone. M. T. BOGERT.

The Action of Alkaline Sulphides upon *p*-Nitrobenzylaniline. BY FREDERICK J. ALWAY AND ARTHUR B. WALKER. *Am. Chem. J.*, 30, 105–110.—*Preparation of p-Nitrobenzylaniline.*—If 1 molecule *p*-nitrobenzylchloride and 2 molecules aniline, in concentrated alcoholic solution, be heated together on the water-bath for two to three minutes, the yield of *p*-nitrobenzylaniline is 92 per cent. of the theory. An equally good yield may be secured by boiling together for a few minutes 1 molecule of the *p*-nitrobenzylchloride with 4-6 molecules of aniline. *Action of Caustic Alkalies upon p-Nitrobenzylaniline.*—By the action of caustic alkalies upon a hot alcoholic solution of *p*-nitrobenzylaniline, *p*-azoxybenzylidenaniline is produced, the yield reaching a maximum when 1 molecule of the caustic is used to 4 molecules of the nitro body. *Action of Alkaline Sulphides upon p-Nitrobenzylaniline.*—Alkaline sulphides convert an alcoholic solution of *p*-nitrobenzylaniline into *p*-azoxy- and *p*-amino-benzylidenaniline. The best yield of the azoxy body is obtained when 1 molecule of the sulphide acts upon eight of the nitro compound. As the proportion of sulphide is increased the yield of the azoxy compound decreases and that of the amino compound increases. M. T. BOGERT.

The Relations Existing between the Physical Properties and the Molecular Weights of *p*- and *m*-Nitrosobenzaldehyde. BY FREDERICK J. ALWAY AND WALTER D. BONNER. *Am. Chem. J.* 30, 111–115.—Nearly all nitroso compounds possess the property of forming colorless solids, while in solution or in the liquid state they exhibit a strong green or blue color, the colorless form being due to a dimolecular condition, while the monomolecular state is present in the colored solutions and melts. Both *m*- and *p*-nitrosobenzaldehyde are green in the liquid state or in solution; the meta compound forms white crystals, while the para forms yellow ones. The para body is, therefore, exceptional in that it is not colorless in the solid state, and the molecular weight determinations furnish no explanation of the cause of this anomaly. In boiling benzene and in freezing acetic acid, both *m*- and *p*-nitrosobenzaldehyde show normal molecular weight; in freezing benzene, the para body is monomolecular, the meta partly dimolecular, the change in condition of the latter being accompanied by a change in the intensity of the green color of the solution. A change in the color of the para solution, on the other hand, is accompanied by a separation of yellow crystals. M. T. BOGERT.

Certain Substitution Derivatives of Ethyl Anilinomalonate. BY RICHARD SYDNEY CURTISS. *Am. Chem. J.*, 30, 133–144.—The substance previously reported as the product of the action of nitrous acid upon ethyl anilinomalonate is believed to possess one or the other of the following structures:

$$\begin{array}{l} C_6H_5N \\ \quad | \\ HO-N \end{array} \!\!>\! C \!<\! \begin{array}{l} COOC_2H_5 \\ \\ COOC_2H_5 \end{array} \qquad C_6H_5N(NO)-CH(COOC_2H_5)_2.$$

I. II.

As this substance breaks up very readily, the nitroso derivatives of the corresponding *o*-, *m*- and *p*-toluidinomalonates were investigated in the hope of finding more stable substances. The ethyl *o*-, *m*- and *p*-toluidinomalonates were prepared from ethyl brommalonate and the required toluidines. They are weak bases, their salts with strong acids being dissociated by water. Treated with nitrous acid, they yield thick, amber-colored oils, which give yellow solutions or stable, yellow, crystalline salts with caustic alkalies, show the Liebermann nitrosamine reaction, and are slowly colored deep red by ferric chloride. EXPERIMENTAL.—*Ethyl o-toluidinomalonate* is a colorless oil, reddening on standing, which dissolves in various organic solvents, and slowly reduces ammoniacal silver solutions or alkaline permanganate. Its *chloride* is a white or pink-white crystalline solid, m. p. 87°–90°, turning magenta in the light and fuming in the air. *Ethyl nitroso-o-toluidinomalonate*, prepared by the action of nitrous acid upon either the above free base or its chloride, is a thick oil of a slightly reddish tint. *Ethyl m-toluidinomalonate* forms colorless needles, m. p. 50.5°–51°. Its *chloride* crystallizes in rosettes of white, silky needles, m. p. 80°–83°. *Ethyl nitroso-m-toluidinomalonate* forms transparent, pinkish-amber prisms, m. p. 58°–58.5°, which become highly electrified when rubbed with a glass rod. *Ethyl p-toluidinomalonate*, a crystalline solid, has been described already by Blank. *Ethyl nitroso-p-toluidinomalonate* is best purified by decomposing the pure sodium salt with carbon dioxide. It is a clear, greenish yellow oil of the consistency of honey, turning slightly red on long standing. It may be obtained in short, monoclinic prisms by dissolving it in ligroin and letting the solution stand for a long time at −15°; but these crystals liquefy again very readily and are very soluble in all ordinary organic solvents.

M. T. BOGERT.

On the Condensation of Oxalic Ethyl Ester with Ethylene and Trimethylene Cyanides. BY ARTHUR MICHAEL. *Am. Chem. J.*, 30, 156–163.—By the interaction of ethyl oxalate, ethylene cyanide and sodium (or alcoholic sodium ethylate), *β,γ-dicyano-α,δ-diketoadipicethylester*, $C_2H_5OOC.CO.CH(CN).CH(CN).CO.COOC_2H_5$, was obtained. It crystallizes in long, straw-colored prisms or in small, prismatic needles, m. p. 121°–123°. It is easily

saponified by boiling dilute HCl, giving a thick *oil*. Using trimethylene cyanide instead of ethylene cyanide, the product was *β,δ-dicyano-α-ketoglutaric ester*, $NC.CH_2.CH_2.CH(CN).CO.COOC_2H_5$, which crystallizes from benzene in nearly white, six-sided prisms, m. p. 96°–98°. Hydrochloric acid saponifies it with loss of CO_2 and formation of a thick oily *acid*. No cyclic condensations could be obtained in these reactions. M. T. BOGERT.

The Nitrosobenzaldehydes. BY FREDERICK J. ALWAY. *Ber. d. chem. Ges.*, 36, 2303–2311.—*p-Hydroxylaminobenzaldehyde*, $HONHC_6H_4COH$, is best prepared by reduction of the nitro aldehyde with zinc dust, alcohol and glacial acetic acid. When its solution stands in the air, a red precipitate of the N-*p*-formylphenylether of *p*-azoxybenzaldoxime gradually separates, its formation being greatly hastened by blowing a stream of air through the hot solution. Oxidation of the alcoholic solution of *p*-hydroxylaminobenzaldehyde with dilute sulphuric acid and potassium dichromate, or with 10 per cent. ferric chloride solution, gives *p*-nitroso- and *p*-azoxy-benzaldehyde. But if the hydroxylamino aldehyde, in alcoholic solution, be mixed with caustic soda and shaken with air till the red color has disappeared, and then mixed with excess of hydrochloric acid, a precipitate of *p*-azoxybenzaldehyde is obtained, colored slightly reddish by an impurity which is possibly the *p*-azobenzaldehyde. Heated in a test-tube, the azoxy aldehyde decomposes with flame. N-*p-formylphenylether of p′-nitrobenzaldoxime*,

$$O_2NC_6H_4CH.\underset{\diagdown\!\diagup\atop O}{}NC_6H_4COH,$$

may be obtained from *p*-nitrobenzaldehyde, not only by electrolytic reduction in concentrated sulphuric acid, or by reduction with zinc dust and acetic acid, but also by mixing its cold sulphuric acid solution with a solution of *p*-hydroxylaminobenzaldehyde. It crystallizes from pyridine in brownish-yellow needles, m. p. 224°. N-*p-formylphenylether of p-azoxybenzaldoxime*,

$$HOCC_6H_4N.\underset{\diagdown\!\diagup\atop O}{}CHC_6H_4N\underset{\diagdown\!\diagup\atop O}{-}NC_6H_4CH.\underset{\diagdown\!\diagup\atop O}{}NC_6H_4COH,$$

was described in previous papers of the author, but its structure has only just been discovered. It may be formed: (1) By electrolytic reduction of the N-*p*-formylphenylether of *p*-nitrobenzaldoxime in concentrated sulphuric acid solution, (2) by the action of oxygen or air upon *p*-hydroxylaminobenzaldehyde, (3) by the action of zinc dust upon a glacial acetic solution of *p*-nitrobenzaldehyde, (4) by condensation of *p*-hydroxylaminobenzaldehyde and *p*-azoxybenzaldehyde with sulphuric acid. On oxidation with ferric chloride or dichromate mixture, it gives *p*-nitrosobenz-

aldehyde and *p*-azoxybenzaldehyde. *Preparation of p-Nitrosobenzaldehyde from p-nitrobenzaldehyde* is carried out by reducing the nitro aldehyde to the hydroxylamino aldehyde, oxidizing the latter to a mixture of nitroso- and azoxybenzaldehyde, and driving over the nitroso aldehyde with steam. Reduction of the alcoholic solution of *p*-nitrobenzylchloride with zinc dust and acetic acid yields *p*-nitrosobenzaldehyde and not *p*-nitrosobenzylchloride. *Reduction of m-nitrobenzaldehyde* with zinc dust, alcohol and acetic acid, leads to the formation of *m*-hydroxylaminobenzaldehyde, the N-*m*-formylpheuylether of *m*-nitrobenzaldoxime, and a gray compound identical with the insoluble substance obtained by the electrolytic reduction of the latter. The crude reduction-product is oxidized and then distilled with steam ; *m*-nitrosobenzaldehyde passes over, while *m*-azoxybenzaldehyde remains in the flask. The *action of p-toluidine upon p-nitrosobenzaldehyde* gives *p*-azoxybenzylidene *p*-toluidine, $ON_2(C_6H_4CH : NC_7H_7)_2$, and *p-tolueneazo-p-benzylidene-p-toluidine*, $CH_3C_6H_4N : NC_6H_4CH : NC_6H_4CH_3$. The latter crystallizes from benzene in orange-red leaflets, m. p. 170°–171° (corr.); 27 per cent. nitric acid converts it to *p-tolueneazo-p-benzaldehyde*, $CH_3C_6H_4N : NC_6H_4COH$; long, red needles, m. p. 177.5° (corr.). M. T. BOGERT.

The Nitroso Benzoic Acid Esters. BY FREDERICK J. ALWAY AND ARTHUR B. WALKER. *Ber. d. chem. Ges.*, 36, 2312–2314.—The authors have prepared several esters of the *o*-, *m*- and *p*-nitrosobenzoic acids by reducing the corresponding nitrobenzoic esters with zinc dust, alcohol and acetic acid, oxidizing the hydroxylamino compound thus formed to the nitroso state, and separating the nitroso ester from the azoxy body produced at the same time by the volatility of the former with steam. Like *p*-nitrosobenzaldehyde, the *p*-nitrosobenzoic esters are green in solution or when fused, but yellow in the solid state. EXPERIMENTAL.—*o-Nitrosobenzoicmethylester*, $ONC_6H_4COOCH_3$, crystallizes from glacial acetic acid in colorless needles, m. p. 153° (uncorr.). The *ethyl ester* is a white powder, m. p. 120°–121° (uncorr.). *m-Nitrosobenzoicmethylester*; white crystals, m. p. 93° (corr.). *m-Azoxybenzoicmethylester*, $ON_2(C_6H_4COOCH_3)_2$, crystallizes from glacial acetic acid in orange needles, m. p. 136°–136.5° (corr.). *p-Nitrosobenzoicmethylester* ; straw-colored needles (from alcohol), m. p. 128°–129.5° (corr.). *p-Azoxybenzoicmethylester*; red needles (from alcohol), m. p. 206.5°–207.5° (corr.), the red color being probably due to a trace of the azo ester.

M. T. BOGERT.

***m*-Nitro-Nitrosobenzol.** BY FREDERICK J. ALWAY. *Ber. d. chem. Ges.*, 36, 2530–2531.—If *m*-dinitrobenzene be reduced with zinc dust, alcohol and acetic acid, the reduction mixture oxidized with ferric chloride and then distilled with steam, *m-nitro-nitrosobenzene* passes over. Recrystallized from alcohol, it appears as a

nearly white or blue-green powder, m. p. 85° (corr.). In one case, long, blue-green needles, m. p. 81°–82° (corr.), were obtained. It unites with aniline to form *m*-nitroazobenzene.

M. T. BOGERT.

As to the History of Isocinnamic Acid. BY ARTHUR MICHAEL. *Ber. d. chem. Ges.*, **36**, 2497–2498.—A reply to a recent article by Liebermann (*Ber. d. chem. Ges.*, **36**, 1448 (1903)). The author explains that further work upon isocinnamic acid has been delayed by the impossibility of reproducing the acid of m. p. 36°, in spite of many attempts. Attention is called to certain facts observed by Liebermann, in the latter's investigation of the same subject, for which a satisfactory explanation is still lacking.

M. T. BOGERT.

On Some Pseudodithiobiurets. BY TREAT BALDWIN JOHNSON. *Am. Chem. J.*, **30**, 167–182.—Pseudothioureas, $HN:C(SR).NH_2$, combine smoothly with isothiocyanates to give a new class of pseudodithiobiurets, $RNHCSN:C(SR)NH_2$. Methyl iodide unites with certain of these dithiobiurets to form dipseudodithiobiurets, $RN:C(SR)NHC(SR):NR$. Phenylhydrazine only removes the isothiocyanate from the dithiobiurets, leaving diphenylthiosemicarbazide, and does not cause the formation of any triazole bodies. The nitrogen and sulphur atoms in the biurets are indicated as follows :-$\underset{(a)}{N}:\underset{(1)}{C(S—)}\underset{(b)}{\overset{|}{N}}.\underset{(2)}{C(S—)}\underset{(c)}{N}:$. EXPERIMENTAL.—(By Howard S. Bristol). *a-Phenyl-1-thiolmethylpseudodithiobiuret*, $C_6H_5N:C(SCH_3)NHCSNH_2$, prepared by Tursini's method from phenyldithiobiuret, methyl iodide and ammonia, crystallizes from alcohol in long prisms, m. p. 122°. *a-Phenyl-2-thiolmethylpseudodithiobiuret*, from phenylisothiocyanate and thiolmethylpseudothiourea; prisms (from alcohol), melting with effervescence at 124°. *a-Phenyl-2-thiolethylpseudodithiobiuret*, from phenylisothiocyanate and thiolethylpseudothiourea; tables, m. p. 114°. *p-Tolyl-thiolmethylpseudothiourea*, $C_7H_7N:C(SCH_3)NH_2$, crystallizes from petroleum ether in plates, m. p. 65°–67°. Its hydriodide is formed by the action of methyl iodide upon *p*-tolylthiourea, and melts with effervescence at 129°–130°. With phenylisothiocyanate, the free base unites to *a,p-tolyl-c-phenyl-1-thiolmethylpseudodithiobiuret*, crystallizing from alcohol in prisms, m. p. 93°. This in turn combines with methyl iodide to form *a,p-tolyl-c-phenyl-1,2-thiolmethyldipseudodithiobiuret*, $C_7H_7N:C(SCH_3)NHC(SCH_3):NC_6H_5$, which separates as the hydriodide; colorless prisms (from alcohol), melting at 164° with effervescence. The free base is an oil. *a,p-Tolyl-a-methylthiolmethylpseudothiourea* was obtained as the hydriodide by allowing methyl iodide to act on *p*-tolylthiolmethylpseudothiourea, and melts at 190°–191°

with effervescence. The free base is oily. From this pseudothiourea and phenylisothiocyanate there was produced *a,p-tolyl-a-methyl-c-phenyl-1-thiolmethylpseudodithiobiuret*; prisms (from alcohol), m. p. 124°. The hydriodide forms minute prisms, melting sharply at 182° with effervescence.—(By Morgan S. Elmer). *a,c-Diphenyl-1-thiolmethylpseudodithiobiuret*, from phenylthiolmethylpseudothiourea and phenylisothiocyanate; transparent prisms (from alcohol), m. p. 101°. *Thiolmethylester of phenylthioallophanic acid*, $C_6H_5NHCSNHCOSCH_3$, was obtained by heating *a,c*-diphenyl-*1*-thiolmethylpseudodithiobiuret with 50 per cent. hydrochloric acid; plates (from chloroform), melting sharply at 157°–158° with effervescence. *a,c-Diphenyl-1,2-thiolmethyldipseudodithiobiuret.* Its hydriodide results from combining methyl iodide with *a,c*-diphenyl-1-thiolmethylpseudodithiobiuret, and crystallizes from alcohol in stout prisms, melting with effervescence at 154°–155°. The free base forms colorless needles (from alcohol), m. p. 103°–104°. *a,c-Diphenyl-a-methyl-1-thiolmethylpseudodithiobiuret*, from *a*-phenyl-*a*-methylthiolmethylpseudothiourea and phenylisothiocyanate; stout prisms (from alcohol), m. p. 133°–134°. *a,c-Diphenyl-1-thiolbenzylpseudodithiobiuret*, from phenylthiolbenzylpseudothiourea and phenyl mustard oil; colorless prisms (from alcohol), m. p. 98°–100°. *Benzoyl isothiocyanate and phenylthiolbenzylpseudothiourea* react to produce a solid *substance*, crystallizing from benzene in yellow prisms, m. p. 190°–191°, apparently a triazine derivative.—(By William B. Cramer). *o*-Tolylthiolmethylpseudothiourea was prepared from *o*-tolylthiourea and methyl iodide, and the product proved to be identical with that already described by Dixon. With phenylisothiocyanate, it yields *a,o-tolyl-c-phenyl-1-thiolmethylpseudodithiobiuret*; plates (from alcohol) m. p. 114°–115°. Methyl iodide unites with it to form the hydriodide of *a,o-tolyl-c-phenyl-1,2-thiolmethyldipseudodithiobiuret*, which melts with effervescence at 147°–148°. The free base crystallizes from alcohol in prisms, m. p. 70°–71°. *a-Phenyl-c,o-tolyl-1-thiolmethylpseudodithiobiuret*, from *o*-tolylisothiocyanate and phenylthiolmethylpseudothiourea, crystallizes from alcohol in plates, m. p. 114°–115°; combined with methyl iodide, and the product treated with caustic soda, *a,o*-tolyl-*c*-phenyl-1,2-thiolmethyldipseudodithiobiuret is obtained. *a,o-Tolyl-c-phenyl-1-thiolethylpseudodithiobiuret*, fron phenyl mustard oil and *o*-tolylthiolethylpseudothiourea, crystallizes from dilute alcohol in plates, m. p. 117°–118°. Warmed with 50 per cent. hydrochloric acid, this biuret yields *phenylthioallophanic acid thiolethylester*; plates (from alcohol), m. p. 131°–132°. *a-Phenyl-c,o-tolyl-1-thiolethylpseudodithiobiuret*, from phenylthiolethylpseudothiourea and *o*-tolylisothiocyanate, crystallizes from alcohol in plates, m. p. 95°–96°. By using phenylisothiocyanate, instead of the *o*-tolylisothiocyanate, *a,c-diphenyl-1-thiolethylpseudodithiobiuret* is obtained; plates (from alcohol), m. p. 91°–93°. *a,c-Di-o tolyl-1-*

thiolethylpseudodithiobiuret, from *o*-tolylisothiocyanate and *o*-tolylthiolethylpseudothiourea, crystallizes from alcohol in prisms, m. p. 86°–87°. *a,c-Di-o-tolyl-1-thiolmethylpseudodithiobiuret* from *o*-tolylisothiocyanate and *o*-tolylthiolmethylpseudothiourea; plates (from alcohol), m. p. 122°–123°. M. T. BOGERT.

The Action of Acetyl Chloride upon Selenic Acid. BY ARTHUR B. LAMB. *Am. Chem. J.*, 30, 209–212.—By the action of acetyl chloride upon selenic acid, selenium tetrachloride is formed. M. T. BOGERT.

BIOLOGICAL CHEMISTRY.

Experiments on the Digestibility of Vegetables. BY A. P. BRYANT AND R. D. MILNER. *Am. J. Physiol.*, 10, 81–100.—The vegetables studied were the potato, the beet, cabbage, and green corn, also apple sauce. The results indicate that so far as sources of proteid or fat are concerned, the vegetables studied may be considered of little value. The carbohydrates that they contain appear to be quite well digested and absorbed, and they may, therefore, be considered as of value as sources of energy, a large proportion of which appears to be available to the body. The chief value of many vegetables is, perhaps, that aside from the nutrients or energy they furnish, they add a pleasing variety and palatability to the diet, supply organic acids and mineral salts, and give the food a bulkiness that seems to be of importance in its mechanical action in maintaining a healthy activity of the alimentary tract. The result of these conditions is a favorable influence upon the digestion of other food eaten with the vegetables.

F. P. UNDERHILL.

On the Digestion and Self-digestion of Tissues and Tissue Extracts. BY P. A. LEVENE AND L. B. STOOKEY. *J. Med. Research*, 10 (New Series, 5), 217–228.—In the present research, an investigation of the following points was attempted: Whether the inhibitory action of a tissue on trypsin or pepsin is exercised by its cells or by their soluble constituents. Whether the tissue extracts exercise an inhibitory action on the proteolytic enzymes of other tissues—on the intracellular enzymes. Whether the inhibitory action of the blood and tissues can be increased by means of immunization. The results show that unboiled extract of liver, spleen, blood, egg white, etc., is digested by pancreatic extract slower than one that has been heated previous to the experiment, that the strength of the digestion depends upon the quantity of the enzyme added; that in the pancreatic extract and in the white of the egg there is an inhibitory action against the intracellular enzymes, and that the blood of immunized rabbits offers a markedly higher resistance toward tryptic digestion than that of the normal animal. F. P. UNDERHILL.

On the Chemistry of the Chromation Substance of the Nerve Cell. BY P. A. LEVENE. *J. Med. Research*, 10 (New Series 5), 204–212.—The nucleic acid of the brain resembles those of other origin. In the character of its pyrimidine bases the nucleic acid of the brain resembles those of other tissues, but only the nucleic acids of animal origin. A method of preparation of the nucleic acid and its pyrimidine bases is given. F. P. UNDERHILL.

On the Autolysis of Brain Tissue. BY P. A. LEVENE AND L. B. STOOKEY. *J. Med. Research*, 10 (New Series 5), 212–217. —The results of this investigation show that nerve tissue possesses an autolytic power; that the autolysis is favored by the presence of acetic acid and is inhibited by the presence of alkali; that in the presence of acid the brain tissue exercises no inhibitory action on the process of brain autolysis. Thus in its proteolytic action nerve tissue does not differ from muscle tissue, or from spleen and liver. The experiments also indicate that resistance of this tissue toward self-digestion depends upon the reaction of the tissue. F. P. UNDERHILL.

A Convenient Modification of Tests for Hydrochloric Acid in Gastric Contents. BY CHARLES SUMNER FISCHER. *Am. J. Med. Sci.*, **126**, 666–671.—The method as herein modified is as follows: Determine the free hydrochloric acid with dimethylaminoazobenzene. Determine the total acidity with phenolphthaleïn. Add 0.5 per cent. hydrochloric acid in quantity equal to 0.5 per cent. sodium hydroxide employed. Add sufficient calcium phosphate to make the volume 30 cc. Allow to stand three to four minutes, add animal charcoal to decolorize and filter. Determine the total acidity with rosolic acid. F. P. UNDERHILL.

On Determining the Specific Gravity of Small Volumes of Urine, with a Preliminary Note on a Special Hydrometer (Urino-Pyknometer) Designed to Work with a Few Cubic Centimeters of Urine. BY G. A. DESANTOS SAXE. *N. Y. and Phila. Med. J.*, **78**, 739–744.—A discussion of the difficulty of determining the specific gravity of very small volumes of urine with the ordinary hydrometers, pycnometers, etc., together with a description of a pycnometer so designed as to give accurate results with a volume of urine as small as 5 cc.
F. P. UNDERHILL.

The Reactions of the Blood in Experimental Diabetes Mellitus —A Contribution to Our Knowledge of the Thermolabile Complements. BY J. E. SWEET. *J. Med. Research*, 10 (New Series 5), 255–299.—The subcutaneous injection of phlorhizin which causes a transitory glycosuria is followed by a slight increase, in the rabbit, of the hemolytic complement for bovine erythrocytes, while no influence could be demonstrated upon the amboceptor

for bovine erythrocytes. The intraperitoneal injection of adrenalin chloride is followed by no marked effect upon the blood reactions. The complete removal of the pancreas from dogs, which causes a true diabetes mellitus of severe type, is followed by a marked decrease of the hemolytic activity of the diabetic dog's serum for both rabbits' and guinea-pigs' erythrocytes; this diabetes is further characterized by a complete loss of the normal bactericidal property of the serum of the dog, and the decrease in hemolytic activity is due to the loss of hemolytic complements. No disturbance of the normal relation of the receptors of the erythrocytes to specific hemolytic amboceptors can be demonstrated in the course of a true experimental diabetes. A decrease in the amount of glucose excreted by the diabetic organism cannot be shown to occur in the course of secondary infection, at least during the earlier stages of the diabetes. F. P. UNDERHILL.

PHARMACEUTICAL CHEMISTRY.

Commercial Aloes. BY M. I. WILBERT. *Am. J. Pharm.*, 75, 201–264.—The writer gives a lengthy account of the history, botanical and commercial sources of the various varieties of aloes on the market, in the first part of his paper. He then gives a summary of the more recent work on the chemistry of aloes, from which the following is taken.

It has long been known that aloin differs both physiologically and chemically, for which reason it is usually designated according to the aloes from which it is obtained, as barb-aloin, soc-aloin, from Barbadoes and Socotrine aloes, respectively.

Cape aloes was formerly believed to contain no aloin, but this belief has been disproved by Leger, who found a crystallizable aloin, isomeric with barb-aloin. This investigator states that the aloin from Barbadoes, Curacao or Socotrine aloes consists of two bases; barb-aloin, which may be decomposed into alo-emodin, and a second substance, iso-barb-aloin, not decomposed into emodin. The nitric acid test for Barbadoes aloes is really a test for iso-barb-aloin. W. H. BLOME.

Progress in Pharmacy. M. I. WILBERT. *Am. J. Pharm.*, 75, 285.—The inventive genius of chemists appears recently to have centered upon quinine, around which several new compounds have been built up. The more prominent of these are here given:

Aristochin, a white, almost tasteless powder, said to be diquinine carbonate, and qualitatively and quantitatively the equivalent of quinine hydrochloride.

Chinaphenin, a combination of quinine and phenetidin.

Saloquinine, the salicylic ester of quinine.

Bromochinal, the dibrom salicylate of quinine.

An interesting compound is citarin, sodium anhydro-methyl

citrate, which is supposed to be easily decomposed, one of its decomposition products being formaldehyde. It is said to be a solvent for uric acid, and to be useful in cases of gout and rheumatism.

The writer calls attention to the work of Mr. Daniel Brown on salicin. The latter found a lot of bark containing a total of 5.8 per cent. of salicin, to yield 11.3 per cent. from the inner, 8.0 per cent. from the middle and 2.5 per cent. from the outer bark. Also that the bark contains a larger percentage of salicin in the spring than in the autumn.

A number of the qualitative tests for heroin fail to distinguish that base from morphine. Nitric acid appears to have a specific and characteristic action upon heroin. Upon adding a few drops of 65 per cent. nitric acid to a trace of heroin, the latter quickly goes into solution, having a yellow color. This color changes gradually at ordinary temperatures, rapidly when heated, to a greenish blue, then gradually fades until the liquid is bright yellow. The hydrochloride responds to this test as well as the free base.

In view of the greatly increased price of cod-liver oil, adulteration of that oil with cheaper ones may now be expected. The following is said to be a reliable test for the pure oil. Add three drops of pure nitric acid to fifteen of the oil. A pure oil "will show a red streak at the point of contact that rapidly changes to bright red, and later, after considerable shaking, to lemon-yellow." Other fish oils give first a blue color, then a brown, and finally, after long standing, a yellow color.

Castor oil in powder form is said to be made by evaporating to dryness and powdering an emulsion of castor oil and skimmed milk. This is stated to be the composition and method of preparing the proprietary preparation sold under the name of "Ricinus-Siccol." W. H. BLOME.

Assay of Ferrous Carbonate Preparations. BY F. X. MOERK. *Am. J. Pharm.*, 75, 382.—In the assay of the pill mass or pills of ferrous carbonate, it is quite impossible to determine with accuracy the amount of ferrous carbonate, associated as it is with organic matter. The writer gives a number of results obtained by three methods. He heated, until completely disintegrated, 1 gram of pill mass in diluted sulphuric acid, in a current of carbon dioxide, cooled the mixture and titrated with tenth-normal potassium bichromate V. S. The result was much too high. By treating a like quantity of pill mass with diluted hydrochloric acid, cooling, and treating with stannous chloride, to reduce ferric salt, then with mercuric chloride solution to oxidize excess of stannous chloride, and finally titrating, the results obtained were still higher than by the first method, probably due to the presence of ferric compounds. Finally, like quantities were

ignited until free from carbon, the residue dissolved in diluted hydrochloric acid, and the ferric salt reduced by means of stannous chloride. This was titrated as before. Results obtained by this method were lower than those obtained by the two preceding ones, and give the quantity of ferrous carbonate originally present. This proves his contention that the organic matter has some action upon the volumetric reagent.

He also calls attention to the fact that the ferricyanide used as indicator should first be freed from ferrocyanide by washing the crystals with distilled water, thus overcoming a titration difficulty.

W. H. BLOME.

Basham's Mixture. BY JOSEPH W. ENGLAND. *Am. J. Pharm.*, 75, 383.—This mixture was named after Dr. William Richard Basham, of London, though he gave no special formula for its preparation. A number of formulas varying slightly from one another came into use, of which the first to be published in an American journal was that which appeared in March, 1876, in the *Am. J. Pharm.* Mr. England decries the fact that the tendency of the U. S. Pharmacopoeia has been to decrease the amount of both the ferric acetate and of the ammonium acetate. According to his calculations, a desert spoonful of the present official "solution," as it is now called, contains about $^1/_2$ grain of ferric acetate, $^1/_8$ grain of ammonium chloride and $1^1/_4$ grains of ammonium acetate, which he considers "entirely too small to be of much therapeutic value." The older formulas contained about twice as much iron, and two and a half times as much ammonium acetate.

W. H. BLOME.

Standards for Flavoring Extracts. BY WILBUR L. SCOVILLE. *Am. J. Pharm.*, 75, 151.—Professor Scoville points out that flavoring extracts are not all used for the same purposes, that, of those who use them, few are good judges of quality. He who "lives to eat," the epicure, demands the very best of flavoring, not in the so-called "extracts" only, but in the flavoring and seasoning of all of his dishes. He who "eats to live," the non-epicure, he whose sense of taste has not been carefully educated, and is not infallible, will allow to pass unnoticed a heavy or even a coarse flavor, or an inharmonius flavoring of the various dishes composing his meal. The one will insist upon having a vanilla extract made from the best Mexican beans, while the other will be satisfied with an extract prepared from Tahiti or Vanillon beans, or from some combination of these with vanillin, tonka, or cumarin.

The difference between these flavoring agents is not one of wholesomeness, but one of taste. "If the public finds that the distinction between vanilla and vanillin is too subtile for the average discrimination, and that vanillin holds its flavor better in

cooking, why should the epicure object to the non-epicure enjoying it?" The writer notes the greatly diminished demand for the "rank ether-composed fruit-flavors," which he cites as bearing out his statement that laws are not needed to regulate the standard of flavors; that taste is self-regulative. The only standard that can be lawfully applied is that of wholesomeness.

W. H. BLOME.

SANITARY CHEMISTRY.

Report on Sewage Disposal. J. A. AMYOT. *Provincial Board of Health of Ontario*, **21**, 34–82.—This paper gives a most excellent account of the methods at present in use for the treatment of sewage. Discharge into water-courses, sand irrigation, intermittent sand filtration, chemical treatment, septic tank process, and contact beds. The reactions given for the hydrolysis of fats, sugars, and albuminoid substances through the action of anaërobic bacteria, and the oxidation of these substances through the agency of aërobic bacteria are instructive and interesting. The paper also gives an account of a series of experiments made at Berlin, Ontario, with septic tanks, contact beds and the Stoddard filter. Among the interesting results obtained in the experiments with septic tanks was the showing that the effluent from gas works had no appreciably detrimental effect on septic action, and that with Berlin sewage, which is a strong sewage (2 parts albuminoid ammonia per 100,000 parts) containing tannery waste, brewery waste, wool-washings, and gas works refuse, when the time of passage of the sewage through the tank was twenty-four hours, 53 per cent. of the organic matter, measured by albuminoid ammonia, and 51 per cent. measured by oxygen consumed, was removed, while when the time of passage was fourteen hours, the amount of organic matter removed measured by albuminoid ammonia, was only 41.5 per cent., and by oxygen consumed, 40 per cent. In the experiments with contact beds, four were used; three, each of an area of one two-hundredth of an acre, and a little over three feet deep, were filled to the height of three feet with gravel, and covered with three inches of coarse, sharp sand. The gravel in each of the beds was of different size, with the idea of seeing what difference the size of material would have on the treatment. The beds were started July 8th, and the experiment continued until September 4th. The beds were filled three times during the first half of the period, twice during the second half with the septic tank effluent. The bed filled with one-eighth inch gravel gave the best results, then the bed filled with one-fourth inch gravel, while the bed filled with one-half inch gravel gave the poorest results, and did not remove the tannin-coloring material from the liquid. The percentage reduction in each bed over the septic tank effluent was:

	Albuminoid ammonia.	Oxygen consumed.
Bed No. 1	42.3	51.7
Bed No. 2	34.4	51.0
Bed No. 3	27.8	44.5

The best bed gave an average effluent containing in 100,000 parts, 0.592 part albuminoid ammonia, and 16.43 parts oxygen consumed. Of the total purification of the sewage by the septic tank and the best contact bed, the septic tank did more than two-thirds of the work. The fourth contact bed, size one eight-hundredth of an acre, filled with coke in pieces of one inch in size, run from August 4th to September 8th, gave a very unsatisfactory effluent containing 0.936 part albuminoid ammonia and 29.23 parts oxygen consumed in 100,000 parts. The Stoddard continuous filter, 2 square yards area, 4 feet deep, filled with three-inch hard clinker, was run at the rate of five million gallons per day. The results were unsatisfactory. The odor from the filter was offensive; the effluent contained a flocculent precipitate, and was often putrescible. It had, however, lost its tannin color, and after settling, gave a pretty clear supernatant fluid.

LEONARD P. KINNICUTT.

Changes in the Slow Sand Filter at Lawrence, Massachusetts. *Eng. Record*, 48, 365–366.—The slow sand filter at Lawrence, built in 1893, was planned with the idea of applying the water intermittently, as is done in sewage treatment, and the filter area consisted of one bed of about 2½ acres area. Practically the water was never really applied intermittently, and having only one filter bed of so large dimensions has added materially to the cost of maintenance. No part of the bed could be scraped without a complete cessation of filtering, the city being supplied meanwhile from the reserve in the reservoir, and when scraping became necessary in winter, the whole filter was exposed to freezing. These circumstances tended to diminish the total yield of the filter, and with the increase of population, some remedy was necessary. Two plans were proposed, one by Mr. Collins, which was the construction of two division walls, separating the filter into three sections at a cost of about $5,000, the other by the State Board of Health, which was to cover the present filter-bed at a cost of $47,000, and the immediate construction of two additional beds, each of one acre area. The city decided on the first and least expensive plan. The new arrangement allows two thirds of the area of the filter to be used at all times, any one section being cleaned and refilled without disturbing the others.

LEONARD P. KINNICUTT.

The Latest Report on Additional Water for New York City. *Eng. Record*, 48, 359.—This report, which might be called a preliminary report, is made by Messrs. Burr, Hering, and Freeman, and recommends a gravity supply from the sparsely inhabited

uplands in the Catskills, immediately north of the Croton watershed. According to the report, the works should be planned for an ultimate capacity of 500 million gallons daily, delivered under a head of about 300 feet at the northern limit of the city, and the aqueduct should be built of that capacity throughout most of its length. With this exception however, the first instalment of the new works is to be built for a capacity of 200 million gallons, at a cost of about $50,000,000. It is a rather interesting fact that, although both Mr. Hering and Mr. Freeman have previously made reports on the same subject, they now unite with Mr. Burr in the above plan Mr. Freeman's earlier plan was to utilize waters of the upper Housatonic and Ten Mile Rivers. This plan was objected to on account of probable litigation as utilizing streams flowing into a neighboring state. Mr. Hering, as one of the leading members of the Merchants' Association, approved of the plan of obtaining a filtered supply from the Hudson River, near Poughkeepsie, or from the North Hudson, near Hadley. The present commission, although stating that the Hudson River water can be made pure and palatable by filtration, and should be regarded as a reserve for the more remote future, unanimously recommends the gravity supply from the Catskills.

LEONARD P. KINNICUTT.

Report of Disinfection Tests with Solidified Formaldehyde in the Leininger Generator. *Ohio Sanitary Bulletin*, **8.** 138–149. —This is the report of disinfection tests made with the Leininger generator, using the solidified formaldehyde prepared by the George Leininger Chemical Company, of Chicago. The test organisms employed were pure cultures of *Staphylococcus pyogenes aureus*, *Bacillus diphtheriae*, and *Bacillus typhi abdominalis*, and in some of the series, *Bacillus anthracis* was substituted for *Bacillus diphtheriae*. The results showed that disinfection was not obtained by the use of one ounce of solidified formaldehyde to 1,000 cubic feet, with an exposure of five hours under conditions more favorable for disinfection than will ordinarily be met with in practice ; but if the relative humidity of the air be raised to 70 per cent., disinfection by this process may occur with the less resistant organisms, but with some organisms disinfection will not occur even then. Experiments were also made with the Mulford regenerator, using formalin. The results showed that using ten ounces of formalin to 1,000 cubic feet, disinfection was not produced when the relative humidity was 57 per cent., but did occur when the relative humidity was 70 to 81 per cent. The report concludes by quoting a statement of Mr. M. J. Rosenau, from " Disinfection and Disinfectants," 1902 : " A certain amount of moisture is therefore essential to obtain successful gaseous disinfection. The exact amount of moisture necessary has not yet been accurately determined, but it is probable that the full disin-

fecting power of formaldehyde gas is only obtained if the atmosphere contains 75 per cent. of moisture, and that only when the atmosphere is saturated with moisture is the maximum effect obtained. It is therefore advisable, in dry weather, to place a basin of boiling water in the room just before evolving the gas."

LEONARD P. KINNICUTT.

The Significance of Bacteriological Methods in Sanitary Water Analysis. BY C. E. A. WINSLOW AND C. P. NIBECKER. *Technology Quarterly*, 16, 227–238.—The writers believe that the chemical examination is mainly useful in throwing light upon one point—the amount of decomposing organic matter in the water—although additional information as to the past history of the water is obtained from the determination of chlorine and nitrogen as nitrates, and that the real application of chemistry to water analysis begins where bacteriology ends. In cases where the pollution is so great that the decomposition of the organic matter causes a nuisance, it must be tested by chemical methods, as biological tests will not serve on account of their delicacy. In cases where the danger from pollution is of infection, bacteriological methods furnish the best index of pollution. The bacteriological examination consists in the quantitative examination to determine the number of bacteria, and the qualitative test to detect the presence or absence of intestinal bacteria, and the identification of the colon bacillus and streptococci. The quantitative examination, like the chemical examination, indicates the presence or absence of organic matter; if the bacteria are few, the water may be considered harmless; if the gelatine count is high, the water contains organic matter which may or may not be of sewage origin. The qualitative examination shows whether or not the pollution is due to sewage. Colon bacilli are not found in good waters, or are so rare as not to be found in a majority of 1 cc. samples, but they are found in the majority of 1 cc. samples of water so polluted by sewage as to be dangerous for drinking. The writers, after stating that for a thorough test the attempt should be made to isolate the colon bacilli and streptococci and to work them out in detail, then discuss the two methods which can be used as presumptive tests for intestinal bacteria, *i. e.*, the fermentation test in dextrose broth, and the acid test with litmus-lactose-agar plates. They approve of both of these tests, on the latter of which they have themselves done a large amount of research work, and believe that if in the fermentation test a quantity of gas, made up of about two parts of hydrogen and one part of carbon dioxide, is not produced, or if in the litmus-lactose-agar method, red-colored colonies are not obtained, intestinal bacteria are not present in the amount of sample taken. The authors believe that the bacteriological examination of the future will consist of three parts—the gelatine-plate count as an estimate of the

amount of organic decomposition in progress, the total count and the count of red colonies on litmus-lactose-agar as a measure of the organisms that thrive at the body temperature, and a study of a series of dextrose-broth tubes for the isolation of colon bacilli and streptococci, while the simple examination of a dextrose-broth tube and the count on litmus-lactose-agar plates will serve for presumptive tests. LEONARD P. KINNICUTT.

The Filtration Works of the East Jersey Water Company at Little Falls, New Jersey. BY GEORGE W. FULLER. *Am. Soc. Civil Eng.*, 1903, 394–472.—This paper, giving a full and admirable account, with half-tone plates and diagrams, of what can be considered as the most modern plant for the mechanical filtration of water, is of such a nature that a short abstract is impossible, and those interested in the purification of water supplies must be referred to the original paper. However, to give an idea of the plant, it may be said that the works have a nominal net capacity of 32,000,000 gallons, and are capable for at least short periods of yielding 42,000,000 gallons daily. The coagulating and subsiding basin has a capacity of 1,750,000 gallons. The clear water basin, divided into two compartments, has a capacity of 3,500,000 gallons. The rectangular filter-tanks, 32 in number, are 24 by 15 feet, and 8 feet deep, the total area of filtering surface being 11,520 square feet. The effective size of the sand and the uniformity coëfficient vary slightly on the different filters, the effective size ranging from 0.38–0.44, and the uniformity coëfficient from 1.32–1.50. For washing the sand, compressed air under low pressure is used in place of the old mechanical device with rake arms. The coagulant used is aluminum sulphate obtained from the Penn. Salt Manufacturing Co., at a cost of about 1 cent. a pound. It contains no free sulphuric acid, practically no sediment, about 17 per cent. of water-soluble aluminum oxide, and traces of iron oxide. The average amount used up to February 1st, was 1.3 grains per gallon, or computed from the filtered water, 1.35 grains. The range in quantity varied from 0.29–2.17 grains. During high water, the water of the river has so low an alkalinity that a solution of soda-ash has to be added to the water to be filtered; from December 17–30th, the amount of soda-ash added averaged 0.49 grain per gallon. The normal rate of filtration is 125,000,000 gallons per acre daily, or about 2 gallons per square foot per minute. A close watch has been kept upon all the principal features of the work, and the report includes numerous tables of analytical results. The turbidity of the water has been reduced from about 6 to $1^1/_2$, the color from 40 to about 7, and the bacterial efficiency has averaged 98 per cent. during the ten months from September, 1902, to June, 1903. The two months which averaged the largest number of bacteria in the filtered water were September, 1902, 190 per cubic centimeter, and January,

1903, 110 per cubic centimeter; in all the other months the number has been below 100. The number of bacteria in the unfiltered water ranges from 1000 to about 6000 per cubic centimeter.

LEONARD P. KINNICUTT.

PATENTS.

APRIL 28, 1903.

726,588. Wm. G. Stephens, Memphis, Tenn. Assignor ½ to Sidney M. Neely and J. Walter May, same place. **Alloy.** Copper 75, tin 20, borax and lampblack 2½ per cent. each.

726,614. Frederick A. Anthony, Hackensack, N. J. Making **nitrocellulose.** Apparatus for winding a web of fabric spirally upon a drum and coating it at the same time.

726,623. Wm. M. Blakeman, Jr., New York, N. Y. **Pigment.** Zinc oxide mixed with zinc hydroxide.

726,727. James M. Brooks, Clifton, Texas. **Egg-preserving compound.** Lard 60, formaldehyde, petroleum jelly 50, paraffin 10, beeswax 12, and oil of citronella 0.1 part.

726,667. Emile A. Fourneaux, New York, N. Y. Assignor to Herman A. Metz, Brooklyn, N. Y. **Blue basic dye.** An acid ice-cold solution of a symmetrical dimethyl phenosafranine is treated with one-half molecule of an alkaline nitrite, and transforming the intermediary product thus obtained by allowing it to stand some time or by boiling it. The dye is readily soluble in water and alcohol, and is a dark purplish powder dissolving in concentrated sulphuric acid yellow-green, turning blue on dilution and on reduction with zinc dust and acetic acid, turning yellow with green fluorescence, but on exposure to the air becoming carmine with yellow fluorescence, finally assuming a purplish blue tint.

726,688. Benno Homolka, Frankfort-on-Main, Germany. Assignor to Farbwerke, vorm. Meister Lucius und Bruning, same place. **Indigo mixture.** Ortho nitro phenol lactic acid methyl ketone is mixed with salts of benzylated aromatic bases, the product being soluble in water and giving indigo on addition of alkalies.

726,695. Myrtil Kahn, Elberfeld, Germany. Assignor to Farbenfabriken of Elberfeld Co., New York, N. Y. **Black azo dye.** *o*-Aminophenol-*p*-chloro-*o*-sulphonic acid is combined with 1,5-dihydroxynaphthalene, making a brown-black powder soluble in water, turning blue by soda-lye but violet on adding more caustic soda, dyeing wool from acid bath violet-red to violet and becoming black on chroming.

726,762. Julian H. Rivers, St. Louis, Mo. Assignor to United States Fiber Stopper Co., same place. A **pulp stopper** of paper and cellulose.

726,776. Edward P. Smith, Chattanooga, Tenn. Assignor two-thirds to Mark L. Morrison and Georg Schindler, same place. **Substitute for cork.** Wood-pulp 3, cornstalk pith, gelatine and glycerin 1 each, and formaldehyde 1 to 5, and 4 parts of water.

726,783. Nathaniel Thurlow, Niagara Falls, N. Y. Assignor to Port Chester Chemical Co., New York, N. Y. **Derivative of pinene.** Turpentine and oxalic acid, both anhydrous are heated with alkali, then distilled and the product collected, which is a complex oil containing pinyl oxalate and formate, borneol oxalate and formate and camphor, the oil having a boiling-point of about 185.

726,802. Bella T. Nichols, Monte Vista, Colo. **Treating ore.** Pulverized ore is mixed with lime-water and steam added, and the pulp thereby agitated and heated; it is then washed with water and dried. WM. H. SEAMAN.

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726,884. Wm. F. Downs, Jersey City, N. J. Treating **rebellious ores of rare metals.** The ores are intimately mixed with a sodium compound and carbon, the mixture heated till the sodium is set free and unites with the rebellious elements, ingredients of the ore, leaving the metal distributed throughout the mass, from which it is finally extracted, the volatile compounds escaping.

726,927. Harry J. Hofmayr, Ventura, Cal. **Bleaching nuts.** The nuts are agitated in a mixture of oxalic acid 2, hyposulphite of soda 7, water 500 parts and sawdust 3000 parts, dampened with dilute sulphuric acid 500 parts, and dried. All parts by weight.

726,932. Karl Huth, Barnsdorf, Germany. Assignor to Bronzefarbenwerke, vormals Carl Schlenk, Roth near Nuremburg, Germany. **Bronze powder.** The melted metal is poured on to a rotating cylinder, and the bands thus formed are peeled off and stamped to a fine powder.

727,024. Julius Tafel, Wurzburg, Germany. Assignor to C. F. Bohringer and Sohne, Mannheim-Waldorf, Germany. **Camphidone.** A solution of imido-camphoric acid in sulphuric acid is electrolyzed in the cathode compartment of an electrolytic cell, the sulphuric acid precipitated by calcium carbonate, and the camphidone extracted by chloroform. It has a melting-point of 220° C., subliming at higher temperatures, and boiling at 308°, readily soluble in ordinary solvents except cold water, and having the formula $C_{10}H_{17}NO$.

727,025. As above but for making **hydroxylamin**. Nitric acid is gradually added to an electrolytic bath of hydrochloric acid, while cooling and stirring it in the cathode chamber, and applying the current. The proportions are such as to form a little hydrogen.

726,026. As above but for **camphidine.** The process of 727,024 is carried out and the filtrate is saturated with alkali to separate the camphidine. This melts at 188° C. to a colorless liquid distilling at 209° C. It is a strong base, soluble with difficulty in water, and having a camphor-like odor.

727,055. Karl Arnold, Riga, Russia. **Packing for stuffing boxes.** Asbestos paper is treated with light spar, talc and hemp, saturated with tallow and mineral oil, and wound in a roll forming a core, which is enclosed in a spun cover saturated with light spar and graphite in the process of spinning, and the whole coated with tallow and paraffin brushed over with flake graphite.

727,062. Melvin W. Beardsley, Oakland, Cal. **Explosive.** Metallic salts as potassium nitrate are finely pulverized and the particles coated with corn oil, and afterwards carbon and sulphur are added and the whole well mixed.

727,088. Carl P. Carlson, Langbron, Dingelvick, Sweden. Assignor to Adolf W. Waern, Brooklyn, N. Y. **Retaining soda-ash dust.** A tank is arranged to contain a lye solution and to permit the passage of gases carrying soda-ash dust, with a shaft carrying staggered baffle plates and means for rotation whereby the baffile plates are dipped in the lye, and the moist surfaces caused to collect the dust.

727,095. George E. Cox, Niagara Falls, New York. Assignor to the Union Carbide Co., same place. Utilizing **calcium carbide refuse.** A mass of it is placed between electrodes of higher conductivity than the refuse, and a current passed through of sufficient energy to make it into an ingot.

727,101. George L. Curtis, New York, N. Y. Assignor to Edward G. Goodwin, Worcester, Mass. **Ozone generator.** An open-ended shell, an exhausted tube mounted within and insulated from said shell, a metallic cap on one end of said tube, a lining over a portion of the circumference of said tube, electrical connection between the cap and lining and an exhausted tubular handle fastened to one end of said shell.

727,117. Thomas A. Edison, Llewellyn Park, N. J. Assignor to Edison Storage Battery Co., Orange, N. J. **Reversible galvanic battery.** An alkaline electrolyte, a nickel oxide electrode as depolarizer and an iron copper electrode, the former being in excess, and combined with graphite.

727,132. Albert Haase, Essen-on-Ruhr, Ass, Germany. Assignor to Friedrich Krupp, same place. **Charging shot for shrapnel.** Alloy of steel, wolfram and nickel.

727,184. Robert McKnight and Moses Saterasky, Philadelphia, Pa., said Saterasky assignor to Finley Acker, same place. Treating **refractory ores.** The ore is roasted in free air with agitation but shut off from the products of combustion till a metalloid

oxide is formed and passes off, together with the metal of the ore in a finely divided state, collecting the mixed fumes in a vessel containing a solution of an alkaline chloride, converting in said receptacle the oxide of the metalloid into an acid, and replacing the hydrogen of the acid with an alkali or alkaline earth metal thereby setting free nascent chlorine, and forming a chloride of the metallic values in a finely divided state.

727,266. James A. Bellon Lescauches, Paris, France. **Purifying gas.** A washing fluid is sprayed into contact with the gas, the mixture atomized and agitated by centrifugal force causing the gas and liquid introduced near the center of rotation to move from the center of rotation to the circumference, at the same time subjected to repeated impacts or shocks. Adapted to purify furnace gases.

727,270. Augustus Bischler, Basle, Switzerland. Assignor to Basle Chemical Works, same place. Making **Indoxyl.** An alkali salt of phenyl-glycine is heated with caustic alkalies and sodium oxide.

727,292. Frederick Cleff, Rauenthat, near Barmen-Rittershausen, Germany. **Aniline-black dyeing.** Uses formic acid as an ingredient in the usual mixtures.

727,297. George B. Convers and Arthur B. De Saulles, South Bethlehem, Pa. Apparatus for making **zinc dust.** A plurality of muffles arranged at different heights, a furnace for external heating, and a common expansion chamber of such relative capacity as immediately to expand and solidify the zinc.

727,381. Adolphus A. Knudson, Brooklyn, N. Y. **Preventing electrolysis** in propeller shafts. Copper-plates the shaft to prevent electrolysis between it and the bronze liners.

727,382. **As above,** but uses a nickel steel shaft and liners of an iron alloy containing nickel of the same polarity as the shaft.

727,387. Emil Kraus, Basle, Switzerland. **Blue sulphur dye.** Nitroso phenols are condensed with alphylated aromatic amino compounds, the resulting products are reduced to alphyl-*p*-amino-*p*-hydroxydialphyl amino compounds, and these treated with polysulphides.

727,389. Heinrich Laubmann, Hochst-on-Main, Germany. Assignor to Farbwerke, vorm. Meister Lucius und Bruning, same place. **Blue dye.** The sodium salt of anthrachrysone is acted on by sulphuric dialkyl esters, the product treated with fuming sulphuric acid, then nitrated to dinitrosulphonic acids. In the form of their alkaline salts they are dark blue, crystalline powders, soluble in water blue, in concentrated sulphuric acid dark yellow turning to blue on dilution, and dyeing unmordanted wool blue in the acid bath.

727,425. Ludwig von Orth, Berlin, Germany. **Medicated**

baths. A series of coils of perforated pipes are mounted on a base of approximately the shape of a bathtub, the pipes are covered with fabric and connected with a suitable gas supply, the whole adapted to saturate the bath with gases, therapeutic or other.

727,457. Pedro G. Salom, Philadelphia, Pa. **Continuous electrolytic apparatus.** A supply receptacle with a slotted outlet in proximity to the surface of an electrode, means for rotating one element in relation to the other so that a coating of the material to be acted on may be continuously applied, and a scraper so arranged as to continuously remove the material which has been acted on.

727,505 to 727,512 inclusive are to Frederick J. Warren, Newton, Mass., for **asphalt pavements,** of which 727,507 is particularly for a mixture of asphalt and lampblack. The rest relate to mixtures of various asphalts.

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727,585. Frank Bunyan, Stratford, Canada. **Food product.** Cleaned potatoes are softened by heat, made into a thin pulp by water, strained, spread out in thin films, and dried.

727,609. Edmond Fourche, Paris, France. Assignor to E. Cornelius Benedict, John S. Seymour, and Eugene Bournonville, New York, N. Y. **Apparatus for storing gases.** A receptacle fitted with a porous substance molded to fit the vessel and adapted to be saturated with a solvent of the gas to be stored, as acetone and acetylene.

727,626. John D. Hawkins and Herbert W. Fox, Colorado Springs, Col. **Halogenizing ores.** Crystals of a halogen hydrate, as chlorine hydrate, which are stable at a low temperature, are brought into proximity with the ore, and the temperature of the mixture allowed to rise so as to liberate free chlorine. Or the halogen crystals may be enclosed in ice and then applied.

727,650. Carl Linde, Munich, Germany. Assignor one-third to Charles F. Brush, Cleveland, Ohio. **Liquefying gases** and separating gaseous mixtures into their constituents. A gas or mixture of gases is compressed, cooled and expanded into a space maintained at a lower pressure, while the expanded cold gas is caused to absorb heat from compressed gas about to be expanded, whereby the gas is progressively cooled till its critical temperature is reached and a portion of it liquefied. Applied to separate oxygen from air.

727,659. Frederick W. Martino, Sheffield, England. **Extracting noble metals.** Obtains gold, etc., from a cyanide solution by acidifying the solution and treating it at a raised temperature with barium sulfo-carbide.

727,694. Charles F. Russi and Celedonia Cadena, San An-

tonio, Texas. **Artificial fuel.** Sawdust 50, manure 150, sand 75, marl 75, clay 100, and lime-water enough to make a plastic mass.

727,758. Otto Dieffenbach and Adolf Schafer, Griesheim-on-Main, Germany. Assignors to Chemische Fabrik, Griesheim Electron, Frankfort-on-Main, Germany. **Igniting composition.** Phosphorus trisulphide 100, zinc oxide 80, are ground together and mixed with potassium chloride 200, iron oxide 100, and ground glass 150, and made into a paste with glue. A non-poisonous match.

727,792. Wilhelm Hickmann, Frankfort-on-Main, Germany. Assignor to Chemische Fabrik Griesheim, same place. **Permanganates.** An alkaline permanganate is dissolved with a halogen compound of the metal to be united with the permanganate, and the mixture electrolyzed, the electrodes being separated by a diaphragm. Used to make calcium permanganate.

727,798. Max Honig, Brunn, Austria-Hungary. **Tanning extracts.** Waste sulphite cellulose lyes are acted on by zinc and then with sulphuric acid, and then adding a salt as sulphate or oxalate to precipitate insoluble calcium oxalate or sulphate.

727,813. Pierre Lederlin, Chedde, France. **Chlorates and perchlorates.** A neutral chromate is added to the chloride solution and the mixture kept acid during electrolysis by hydrochloric acid.

727,832. Arnold H. Peter, New York, N. Y. Treating **hides.** Applies an aqueous solution of sodium chloride to which is added small quantities of hydrochloric acid at intervals, and then puts the hides in a tanning solution of the same specific gravity as the salt solution.

727,962. Myrtil Kahn, Elberfeld, Germany. Assignor to Farbenfabriken of Elberfeld Co., New York, N. Y. **Black azo dye.** Derived from *o*-amino phenol and 2,6-dihydroxynaphthalene which are brown-black powders soluble in water red to blue-violet, turning blue on adding sodium carbonate, and dyeing wool from acid baths blue, turning black by chroming.

727,963. **As above,** substituting for second component 1,7-aminonaphthol. Soluble in concentrated sulphuric acid blue-red, precipitating on adding ice and dyeing violet from acid baths, turning black on chroming.

727,964. **As above,** substituting for first component nitro-orthoamino phenol, and dissolving blue-red in concentrated sulphuric acid, turning yellowish red on adding ice, and precipitating on adding more ice, dyeing blue, changing to black on chroming.

727,965. **As above,** derived from *o*-amino phenol and 1,5-dihydroxynaphthalene-3-sulphonicacid, soluble in water red to blue-

violet, and dyeing wool from acid bath blue-red to violet, turning black on chroming.

727,966. **As above,** but having for second component 1,7-aminonaphthol-4-sulphonic acid, and are brown-black powders soluble in water red to blue-violet, turning blue with sodium carbonate, and dyeing wool from acid baths blue-red to blue, turning black on chroming.

727,967. **As above** but having as second component 2,6-aminonaphthol, otherwise reacting as 727,964.

728,021. Albrecht Schmidt, Hochst-on-Main, Germany. Assignor to Farbwerke vorm. Lucius und Bruning, same place. **Black azo dye.** An amino sulphonic acid is joined to 1,8,4-naphthalene diamine sulphonic acid, the product treated with a mineral acid and then with a diazotized amine. Disazo dye, dyeing wool black in an acid bath.

728,022. Paul Schultze, Berlin, Germany. Apparatus for recording automatically **carbon dioxide** in products of combustion. In combination, a micromanometer provided with a measuring tube, of a lamp, a mirror for reflecting light through said tube, a recording camera to receive the collected light, a rotating cylinder in said camera having slits and time divisions on one of its bases, and a drum rotating with said cylinder and provided with a sensitive recording sheet acted upon by light through the measuring tube and the slits.

728,070. Otto Zwietusch, Milwaukee, Wis. Collection of **carbon dioxide** from breweries. The fermenting vats are closed and furnished with pipes that lead to a purifying vessel and a gasometer, the whole provided with safety-valves and connecting pipes whereby the gas given off in fermentation may be stored and used for carbonating the beer, etc.

728,079. Harvey R. Brosius and Thomas A. Eshelman, Summerville, Pa. **Flux.** Vaseline 32, zinc 16, sal-ammoniac 1, borax 1, charcoal $^1/_4$ and hydrochloric acid 8 parts.

728,084. Wm. L. Colson, Savannah, Ga. Assignor to Frank M. Wever, same place. **Acid-distributing system.** An acid egg is provided with compressing pump and suitable pipes, relief valves, etc.

728,103. Ferdinand-Christoph von Heydebrand und der Lasa, New York, N. Y. **Artificial fuel.** Coal tar, 15, coal oil 80, sawdust 60, clay and bituminous substance 50, and carbonate of magnesia 5.

728,109. John W. H. James, Philadelphia, Pa. **Pigment furnace.** A cylindrical rotating furnace delivers into a second cylindrical rotary furnace beneath it, the upper one having a spherical enlargement in which melted metal collects combined with means for heating the furnace and causing a flow of oxidizing gases through it.

728,122. Wm. Lynes, Sparkhill, England. Apparatus for **removing fumes** in chemical operations. A hood cap or cover with inspection and pouring gap, and applied to the mouth of a crucible or other similar vessel, and connected with an off-take by a flexible pipe.

728,129. Dmitry A. Peniakoff, Huy, Belgium. Producing **aluminum** and its alloys. Porous aluminum sulphide, with or without other metallic sulphides, is reduced by hydrocarbon gases at a high temperature, and the resultant product melted with a flux of alkaline chlorides or fluorides.

728,148. Frank M. Wever, Savannah, Ga. **Acid distributing system.** Similar to 728,084 but with automatic pressure valves.

728,173. Carl Linde, Munich, Germany. Assignor to Charles F. Brush, Cleveland, Ohio. **Liquefying and separating gaseous mixtures** at low temperatures. A series of gas-compressors and cooling coils through which the gas is made to pass while cooling itself by expansion of a part thereof. The liquid air is separated into a gas rich in oxygen and another poor in oxygen.

728,176. Arthur R. Radtke, Beaverdam, Wis. **Composition for removing soot** from stoves, etc. Powdered fenugreek 1, zinc chloride and zinc sulphite 2 each, loose carbon 4, and sodium chloride 32 parts.

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728,205. Wm. Cormack, Eskbank, Scotland. Assignor one-half to James Gray, Flowerdew, Lawso, Fulton, Scotland. **Making gelatine.** The gelatine-yielding material is washed, cut up and subjected to the simultaneous action of condensing steam and centrifugal force which dissolves out the gelatine, the solution is separated by gravity and centrifugal force, filtered, adjusted for density, and drawn off.

728,217. Herman W. Falk, Milwaukee, Wis. Assignor to Falk Co., same place. **Steel casting** with hardened portions. An aluminum case containing broken manganese is supported within the cavity of the mold which receives the molten steel, all being fused together, whereby a casting is obtained soft on the finishing surfaces and hard beneath the surface.

728,234. Charles C. Hoyt, Brookline, Mass. **Paraffin fabric.** A fabric is coated with a high test paraffin mixed with an essential oil. See 338,806.

728,245. Robert Krayn, Berlin, Germany. **Photographic copying material.** For the pigment process consisting of a film of transparent material, a superposed layer of rubber on which a layer of color mixed with gelatine is placed, and an exterior coating of gelatine.

728,258. Theodore G. Lockwood, Chester, S. C. **Incrustation preventive for steam boilers.** Extract of saw palmetto roots containing little tannic acid.

728,261. Charlie E. Mark, Chicago, Ill. Subjecting materials to the **action of gases.** The material to be treated is placed on a porous furnace bottom through which the gases pass, or are forced.

728,271. Thomas Mitchell, Chester, Pa. Assignor to Daniel Eagan, Philadelphia, Pa. **Hardening car-wheel treads.** Drives jets of air against the hot treads while the wheel is rotating.

728,296. Alvin B. Redell, Chicago, Ill. Assignor to Charles R. Lindsay, Jr., same place. **Bunsen burner.** An integral body portion with socket adapted for securing on a gas supply pipe, a tubular externally threaded stem provided with a stud at its upper end and a discharge opening, and a ring threaded on its inner circumference, a cap inclosing the upper end of said stem on which it screws, and having an opening in its upper end that may be closed by the stud, and a flanged mixing tube threaded to fit the inside of the ring and with an air opening in its wall.

728,335. Sidney Trivick, Clapham, England. Making dry **alkaline sulphate.** An anhydrous sodium salt is added to concentrated sulphuric acid free from water in the proportion of half as many units of sodium as of sulphur in the mixture, granulating by stirring in a current of warm dry air, thus producing a salt with four units of SO_3 and three units of H_2O united to Na_2O.

728,361. Arthur R. Bullock, Cleveland, Ohio. Assignor to Benjamin Parmely, Jr., same place. **Gas-pressure reducing apparatus.** A vertical cylindrical vessel is divided by a partition near the middle with depending central tube, within which plays up and down another tube carrying a float resting on the liquid with which the vessel is nearly filled. Within the central tube is still another tube attached to the float, the flow of gas being controlled by the rising and falling float and its accompanying devices.

728,374. Ada Danmar, Jamaica, N. Y. Composition for preventing the discoloration of **potatoes** when boiled. Alum one and common salt 5 parts with sugar.

728,385. Dittmar Finkler, Bonn, Germany. Making **albumose.** Extracts suitable material first with an alkali solution then with acid, which precipitates the impurities, heating the same and washing out with hot water.

728,388. Emile A. Fourneaux, New York, N. Y. Assignor to Herman A. Metz, same place. **Azo dye.** Consisting of *p*-nitrobenzene azo-β-naphthol derived from equimolecular proportions of a diazo compound a nitrodiazo compound, and a solution of

alkaline β-naphthol. Especially adapted for red lakes and pigments.

728,397. Thomas B. Joseph, Salt Lake City, Utah. **Extracting gold.** Ores of gold or silver are treated with an aqueous solution of potassium cyanide and calcium hydroxide to which about 3 ounces of barium peroxide, to the ton of solution is added, and carbon dioxide, liquefied or as gas, is also forced in by compressed air.

728,452. Joseph L. Ferrell, Philadelphia, Pa. **Fire-proofing wood.** The wood is impregnated with a mixture of salt and aluminum sulphate.

728,455. Emile A. Fourneaux, New York, N. Y. **Red azo dye.** Suitable for red lake and pigment colors derived from β-naphthol, diazotized *p*-nitraniline mixed with other phenolic bodies, forming a gelatinous paste insoluble in water but so finely divided as to react with metallic salts to produce lakes.

728,477. August L. Laska, Offenbach-on-Main, Germany. Assignor to firm K. Oehler, Farbenfabriken, same place. **Blue disazo dye.** Derived from tetrazotized *p*-diamine and the glycines of aminonaphthol sulphonic acids with a naphthol body. Brown-black powders dissolving in water blue, the solution reddened by soda-lye, and precipitated by hydrochloric acid, dyeing unmordanted cotton fast blue.

728,507. James A. Shepherd, Glasgow, Scotland. **Linoleum composition.** Linseed oil 30, gum tragasol 10, and a drier 1 part.

728,528. Frederick C. Weber, Chicago, Ill. Treating **kaolin for carborundum and alumina.** Dissociates the kaolin molecules by heat, driving off the water and forming a clinker of anhydrous aluminum silicate, powdering and mixing the same with coke and subjecting to the electric arc, forming carbides of silicon and aluminum, treating the solid mass thus formed with water to obtain methane and aluminum hydroxide, washing out the aluminum hydroxide from the crystalline carborundum formed, and drying the hydroxide for alumina.

728,566. Claude D. Grove, Colorado Springs, Colo. **Recovering bromine.** After treating ores, the bromates found in alkaline solutions are reduced to bromides by a reducing agent as hydrogen sulphide.

728,600. Leon Naudet, Paris, France. **Extracting sugar.** Circulates a fluid through a diffusion battery at a maintained temperature, cutting out successively the exhausted cells of the battery, filling with fresh material which is heated to the required temperature and then cut in, and the rich saccharine juice from the battery is drawn last through this last cell.

728,623. Albrecht Schmidt and Fritz Bethmann, Hochst-on-

Main, Germany. Assignor to Farbwerke, vorm. Meister, Lucius und Bruning, same place. **Blue sulphur dye.** Dialkyl-*p*-amino-*p*-hydroxy-*m*-*m*-dichlor phenylamine is heated with sulphur and sodium sulphide. Soluble in and dyed from warm sodium sulphide bath.

728,627. Joseph D. Scott, So. Shields and Henry P. Scott, Poplar, London, England. **Boiler-cleaning compound.** Catechu 28, and molasses 56 parts, dissolved in water.

728,680. John T. Davis, San Francisco, Cal. **Artificial fuel.** The hard and soft portions of brea (a natural asphalt of the Pacific coast) are ground separately and mixed with crude oil to form a substitute for bituminous coal.

728,697. George A. Fredenburgh, Pawtucket, R. I. **Sizing.** Potato starch 34, tin oxide 1, zinc oxide 1 pound, water 40 gallons, all steamed and mixed with wood alcohol a half pint, naphtha and caustic soda the same.

728,746. Peter W. McCaffrey, Denver, Colo. Apparatus for **precipitating dissolved metals.** A series of cylindrical tanks are supported over rectangular tanks with partitions connecting the bottoms of both series of tanks and divisions between the cylinders reaching part way down. The cylinders are perforated and contain scrap metal, being adapted to receive a solution at one end and deliver it at the other, and rotating in the solution, whereby a current is maintained through the tanks from end to end.

728,772. Leopoldo Sconfietti Legnano, Italy. **Moistening and cooling air.** Allows high pressure steam to suddenly expand, moistening an air current which is then subdivided for use.

728,778. Heinrich Specketer, Griesheim-on-Main, Germany. Assignor to Chemische Fabrik, Griesheim Electron, Frankfort-on-Main, Germany. Obtaining **chromium compounds and alkalies.** Salts of the alkalies are electrolyzed with an anode containing chromium, adding to the anode an oxide or carbonate of calcium and preventing the mingling of the anode and cathode electrodes.

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728,851. Wm. R. Brixey, Seymour, Conn. **Vulcanized kerite compound.** Coal tar 25, asphalt 15, linseed oil 70, sulphur 14, and talc 56 parts, united with natural India rubber for insulating purposes.

728,854-5. Wm. F. Browne, New York, N. Y. Assignor to Fuel and Gas Manufacturing Co., West Va. **Emulsion fuel compound.** The first for an emulsion of finely divided peat and water, to which the second adds powdered coal, the mixture adapted to be forced into heated pipes to give fuel gas.

728,878. Nicholas Del Grande, Petersburg, Va. Assignor to

Virginia Fire Works Co., same place. **Whistling-boom compound.** Two solutions, one of 3 parts saltpeter and the other 1 part of picric acid are mixed boiling hot; the resulting precipitate is pressed, dried and powdered.

728,889. John Ewing, Jr., Richmond, Canada. **Calcium carbide package.** A close porous inner casing contains the carbide, the whole covered with tinfoil, and a rupturing string is fast to the inner casing and extends through to the outside.

728,914. Nicholas L. Heinz, Lasalle, Ill. Apparatus for making **sulphuric acid.** An acid chamber, a Glover tower, flues to lead acid gases into the sides near the front of the chamber at different levels, and to go out at the sides near the rear end transversely to the length of the system and on opposite sides.

728,918. Edward C. Holton, Cleveland, Ohio. Assignor to Sherwin-Williams Co. of one-half. Producing **paint oil.** Treats blown oils with a hydrocarbon solution of sulphur chloride and thins the resulting mixture with benzene.

728,991. Frederic W. C. Schniewind, Everitt, Mass. Assignor to United Coke and Gas Co., Philadelphia, Pa. **Enriching gas.** Divides the output into rich and poor gases, distils tar containing benzene, which is volatilized, and enriching the gas with the product by forcing some of the richer gas through the still and mixing the product with the remaining richer gas.

729,008-9. Henry M. Sutton, Walter L. Steele and Edwin G. Steele, Dallas, Texas. Apparatus and process respectively for **roasting ores.** A hydrocarbon burner enters a conical vessel at a tangent in which the pulverized ore is caught and whirled and roasted, then subjected immediately to the action of a current of cool air produced by a pump.

729,054. Friedrich Fischer and Hugo Guntrum, Elberfeld, Germany. Assignors to Elberfeld Co., New York, N. Y. **Aminohydroxybenzyl sulphonic acid.** *m*-Amino-*o*-hydroxybenzyl sulphonic acid, which is a white powder stable in air difficultly soluble in cold, more easily in hot water, insoluble in alcohol, ether and acetone.

729,073. Max Kugel, Wiesdorf, Germany. Assignor to Elberfeld Co., New York, N. Y. **Anthracene dye.** Alpha alphyl amino anthraquinones having a hydroxyl group in ortho position to the alphyl amino group are oxidized, forming as alkaline salts colored powders soluble in hot water and dyeing violet to green-blue and chrome mordanted wool green.

729,113. John M. Anderson, Tuskola, Mich. **Uniting metals.** The surfaces to be united are brought together, metal is electrolytically deposited in the joint, which is completed by heat.

729,121. Wm. Boby, London, England. **Softening water.**

The water is passed down through a column still, steam being admitted at the bottom.

729,140. Robert Darling, Rye, N. Y. **Storage battery.** A negative element, and a positive element partly mercury, a metallic conductor from the positive element up through the electrolyte, this conductor protected by a greasy coating and an insulating substance.

729,202. Hans Molchin, St. Louis, Mo. **Fire-bricks.** Ground plaster of Paris 45, sifted coal cinders 50, comminuted mica 2 and 3 parts slaked lime.

729,203-4. **As above,** and for making fire-bricks out of the composition. Water-glass may be added.

729,217. Arnold Rahtjen, Hamburg, Germany. **Brom-indigo.** Bromine is made to react on indigo at a moderate temperature.

729,218. Carl Reimann, Hamburg, Germany. **Improving tobacco.** Tobacco is exposed to the vapors arising from vinegar to which a small amount of camphor has been added.

729,258. Emile G. Bertrand, Paris, France. **Paint for shading glass houses,** from heat, etc. Whitening 285, alum 10, potassium silicate 10, blue color 60, oil 85, and water 550 parts.

729,264. Eugene A. Bourlon, New Caney, Texas. **Insecticide.** One pound each of oils of chenopodium, stramonium leaves and stramonium seeds, one quart alcohol, and 40 gallons water and magnolia extract mixed.

729,297. Eugene R. Edson, Cleveland, Ohio. **Separating grease.** Fish or other grease-yielding material is mixed with cold water to congeal the grease, which rises to the top, and is caused to overflow by a water supply forced below it from an adjoining water tank.

729,321. Oskar Francke, Mulhausen, Germany. Assignor to Martin Heberlein, Eisenach, Germany. **Preparing fuel.** A reduced combustible is mixed with calcium sulphate and treated with dilute nitric acid and glycerin so as to coat the combustible with a nitroglycerin-like substance and water, and adding liquid hydrocarbon such as residues of resin.

729,350. Robert L. Jenks, London, England. Assignor to George A. Clowes and Ernest P. Hatschef, Needham Market, England. Making decolorizing and **clarifying material.** Yeast is mixed with water and heated to 50° C. for several hours, keeping it covered, the dead yeast cells are then separated and digested with 1 per cent. mineral acid, again separated and digested in an alkaline solution, and finally finished with dilute acid.

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[R preceding a number or numbers refers to the Review of American Chemical Research, Pr refers to the Proceedings.]

Additions to the Index for 1903.

(By mistake the following titles were omitted from the Index for the Journal for 1903.)